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April 16, 2001

Assistant Commissioner
of Patents
Washington, D.C. 20231

**ATTN: BOX PCT**
**PCT/AU99/00891**
Attorney Docket: Q-63675

Re: Application of Jack David HAMMOND, Michael Lindsay CRAIG, Arthur Thomas HALLETT and Andrew Rainer GOCKEL for "PARKING MANAGEMENT SYSTEM"

Sir:

Please enter the above application into the national stage commencement under Chapter II. Enclosed is the application as originally filed, claims as originally filed, amended pages 2, 2A, 4, 4A and 5 of the specification and amended pages 40-46 of the claims, Preliminary Amendment, claim to priority, Assignment for recordation and twenty sheets of drawings containing Figures 1-21. It is assumed that copies of the Int'l. Application, Int'l Search Report, Int'l. Preliminary Examination Report, and any Articles 19 and 34 amendments as required by §371(c) will be supplied directly by the Int'l Bureau, but if copies are needed, please notify the undersigned.

The Government filing fee is calculated as follows:

| | | | | | | |
|---|---|---|---|---|---|---|
| Total claims . ..... | 35 | - 20 = | 15 | x $18/09 | = | 135.00 |
| Independent Claims ..... | 04 | - 03 = | 01 | x $80/40 | = | 40.00 |
| Base Fee (1000/500) or (860/430) | | | | | = | 430.00 |
| Multiple Dependent Claim Fee | | | | | = | |
| Assignment Recordal Fee | | | | | = | 40.00 |
| **TOTAL FILING FEE** ..... | | | | | | 645.00 |

Attached please find a check in the amount of **$605.** for the basic filing fee and excess claim fees and a second check in the amount of **$40.** for recordation of the Assignment.

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You are directed and authorized to charge or credit any difference or overpayment to Deposit Account No. 19-4880. You are also authorized to charge any other fee under 37 C.F.R. § 1.16 and 1.17 which may be required during the entire pendency of the application to Deposit Account No. 19-4880, with the exception of the Issue Fee.

Priority is claimed based on the Australian Appl. No. PP6557/98 filed October 16, 1998. The Int'l. Appl. PCT/AU99/00891 was filed October 15, 1999.

A duplicate copy of this letter is attached.

Respectfully submitted,

Robert V. Sloan
Reg. No. 22,775

RVS:jlg
Attachments:

09/807608

JC03 Rec'd PCT/PTO 16 APR 2001

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Jack D. HAMMOND et al.

**based on Int'l. Appl. No. PCT/AU99/00891**

Filed: April 16, 2001

For: PARKING MANAGEMENT SYSTEM

**Att: BOX PCT**

Ass't Commissioner of Patents
Washington, D.C. 20231

Sir:

**PRELIMINARY AMENDMENT**

Prior to the examination of the above identified application, please amend this application as follows:

**IN THE CLAIMS:**

Claim 4. (Amended) A parking management system according to claim 2, wherein the base charging rate is constant over the first time period and the variable charging rate changes over the second time period.

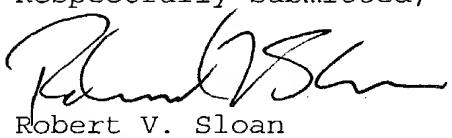
**PATENT APPLICATION**

**REMARKS**

The above claim has been amended to delete the multiple dependencies therein.

An early and favorable action on the merits is respectfully requested.

Respectfully submitted,



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Date: April 16, 2001 Att'y Docket No: Q-63675

PATENT APPLICATION

## APPENDIX

Claim 4. (Amended) A parking management system according to claim 2 [or 3], wherein the base charging rate is constant over the first time period and the variable charging rate changes over the second time period.

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# A PARKING MANAGEMENT SYSTEM

The present invention relates to parking management systems and, more particularly, to parking management systems capable of implementing a variable fee structure for charging parking fees.

Historically, parking meters have mostly been used as stand alone units for measuring a time interval for which a user pays to park in a particular marked parking position and to indicate whether there is still part of that interval remaining. These parking meters generally require payment in advance and will stop timing once the paid parking period has expired. They will then display, or be able to display, the "expired" status to indicate to parking enforcement officers that a fine or an infringement notice should be issued.

Developments in parking management have since seen small computer processors included in the meters which enable the meter to keep time, and receive payment, for a number of different parking bays. However, it is still often necessary for enforcement officers to patrol the parking areas in order to issue infringement notices and fines.

One purpose of a parking management system is to assist the owner or manager of the parking area in policing its use. There are a number of issues associated with achieving this purpose, namely: collecting fees from users; enforcing the payment of fines or penalties levied for unauthorised or excessive use of the parking area; controlling the parking system technology; and providing for the automation of the system so as to reduce the required policing manpower. It is desirable that a parking management system should be so self-sufficient that no manpower is required for policing it and it need only be checked occasionally for maintenance purposes; enforcement officers should be notified automatically of particular instances of infringement so that they may direct their efforts more efficiently; additionally, the means for receiving payment and methods of time-metering should be flexible so as to assist in achieving the parking resource management goals of the owner of the parking resource.

It is an object of the invention to provide a parking management system and method which

achieves the above goals, or which at least provides a useful alternative to known systems and methods.

The present invention provides a parking management system including:

sensing means for sensing the presence of a vehicle in a parking position;

a housing module having:

communication means for communicating with a network;

transaction means, in communication with the communication means and accessible to a user of the system, adapted to process data to effect a payment; and

processing means, in communication with the transaction means for monitoring the sensing means and for determining the payment for an overall time period during which the presence of the vehicle is sensed;

wherein the payment is determined according to a variable fee structure applicable to the overall time period and is effected at the end of the overall time period.

Preferably, the variable fee structure includes a base charging rate and a variable charging rate, the base charging rate being applicable for a first time period and, if the vehicle is sensed longer than the first time period, the variable charging rate being applicable for a second time period after the first time period. Preferably, the overall time period is equal to the sum of the first and second time periods. Preferably, the base charging rate is constant over the first time period and the variable charging rate changes over the second time period. Preferably, the variable charging rate increases over the second time period. Alternatively, the variable charging rate decreases over the second time period.

Preferably, the overall time period is the period of time between an initial receipt of payment information and receipt by the processing means of a user-actuated parking termination signal.

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Preferably, the user-actuated parking termination signal is actuated by the user, either by providing a termination instruction to the processing means through the transaction means, or by moving the vehicle out of the parking position and thereby causing the sensing means to cease to detect the presence of the vehicle in the parking position.

Preferably, if the presence of the vehicle is sensed after a grace period before or after the overall time period, the processing means is adapted to communicate an infringement signal to an enforcement body over the network. Preferably, a nil charging rate is applicable during the grace period.

Advantageously, said charge rate may vary over a predetermined period of time. The charge rate may be low initially and then increased to a high rate when the time reaches a predetermined level. The charge rate may increase linearly or otherwise over the predetermined period of time. A penalty charge rate may be selected after the time reaches a predetermined level.

Preferably, the sensing means is adapted to sense the presence of one or more vehicles in respective one or more parking positions. Preferably, the sensing means includes at least one presence detector which may preferably be an induction coil for each parking position.

Preferably, the housing further includes display means for displaying information to the user, in communication with the processing means.

Preferably, the transaction means includes card reading means for reading credit card information and manual input means for receiving an authorisation code from the user. Preferably, if the user inputs a special vehicle authorisation code into the transaction means, a nil charging rate is applicable for at least a part of the overall time period.

Preferably, the transaction means includes cash payment means for receiving cash payment. Preferably, the transaction means includes card reading means for reading stored-value card information and manual input means for receiving a payment authorisation code from the user.

Preferably, the communication means is adapted to communicate with a financial institution for determining whether the authorisation code is valid and whether there is sufficient credit available to the user to effect the payment. Preferably, the communication means is in communication with a central control station, the central control station being adapted to

receive operational information and financial transaction information from the processing means over the network.

Preferably, the processing means includes memory means. Preferably, the system further includes a transportable programming device adapted to interface with the processing means for reconfiguring thereof and for reading and writing data from and to the memory means. Preferably, the memory means includes further memory means for storing system configuration data, the control station being adapted to selectively change the configuration data stored in the further memory means. Preferably, the programming device is also adapted to interface with a data processing means of the central control station.

Preferably, the transaction means includes means for sensing when an access door to internal components of the housing has been opened.

Preferably, the system further includes diagnostic means for performing diagnostic inspection thereof. Preferably, the diagnostic means of each parking meter includes fault-condition monitoring and counting means for fault monitoring and storing fault-related data. Preferably, the diagnostic means is controlled by the processing means and is adapted to transmit the fault-related data to the control station through a communications network.

Preferably, the housing further includes printing means for printing a receipt for payment.

The present invention further provides a parking meter, including:

sensing means for sensing the presence of a vehicle in a parking position;

a housing module having:

communication means for communicating with a network;

transaction means, in communication with the communication means and accessible to a user of the system, adapted to process data to effect a payment; and

processing means, in communication with the transaction means for monitoring the sensing means and for determining the payment for an overall time

period during which the presence of the vehicle is sensed;

wherein the payment is determined according to a variable fee structure applicable to the overall time period and is effected at the end of the overall time period.

The present invention further provides a parking management system including a plurality of parking meters as described above.

Preferably, the communication means of each parking meter is in communication with a central control station, the central control station being adapted to receive operational information and financial transaction information from the processing means of each parking meter over the network.

Preferably, each parking meter is in communication with one or more local controllers, each of which is in communication with a central control station, the central control station being adapted to receive operational information and financial transaction information from the processing means of each parking meter via the one or more local controllers.

Preferably, the parking management system may be directly connected to a local controller or directly to a control station via a terrestrial, or wireless public or private network. The local controller may also be connected to the control station by via a terrestrial, or wireless public or private network. The local controller may be connected to a data communication interface of the control station via a terrestrial, or wireless network, regardless of whether the network is public or private.

Preferably, the parking management system may include one or more of the following: means for sensing when an EFT unit is located in the housing and means for sensing when a coin/token unit is located in the housing.

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Each parking meter preferably includes an electronic card authenticator. The memory arrangement of each meter includes operational data regarding the number and value of cards received. The operational data may be transmitted to the control station through a communications network.

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Preferably, each parking meter may incorporate an electronic coin or token authenticator. The memory arrangement of the parking meter includes operational data regarding the number and value of coins or tokens received.

Preferably, each parking meter may include a real time clock. The processing means and real time clock of each parking meter being adapted to allocate time data to predetermined events and to store said time data and data relating to the kind of event in the memory arrangement. The real time clock on the parking meter may be synchronised with the control station time by the said communications network or the field programming device.

The present invention further provides a method for effecting payment for parking, including the steps of:

monitoring a presence signal, representative of the presence or absence of a vehicle, from at least one parking bay;

receiving payment information from a user of said parking bay which enables a payment;

selecting at least one charging rate, of a plurality of charging rates, applicable over at least one respective charging period;

determining a length of time said vehicle is present in said at least one parking bay in response to the presence signal;

determining the payment based on the selected said at least one charge rate applicable over the length of time; and

effecting the payment.

The present invention further provides a method for managing a parking system, including the steps of:

sensing the presence or absence of a vehicle in a parking position;

selecting one or more fee charging rates from a plurality of fee charging rates applicable under one or more circumstances of use of the system;

receiving payment information relating to the payment of fees and authorisation thereof by a user of the system;

establishing a start time from which fees may be charged, the establishing of said start time being responsive to the sensing of the presence of said vehicle in said parking position;

establishing a finish time beyond which fees will not be charged, the establishing of said finish time being responsive to a timing termination signal actuated by said user;

calculating fees to be received from said user based on said one or more fee charging rates applicable under said one or more circumstances of use between said start time and said finish time;

using said payment information to effect receipt of a payment from said user based on said calculated fees.

The present invention further provides a method of managing a parking resource including a plurality of parking positions, the method including the steps of:

providing one or more parking meters, as described above, to monitor utilisation of the parking positions;

providing a connection to each parking meter, through a communications network, to a control station having processing means;

causing each parking meter to regularly perform self-diagnostic tests and to store data relating to those tests;

causing each parking meter to store operational data relating to payment transactions performed by that parking meter;

causing the parking meters to transmit the data relating to the self-diagnostic tests or the operational data to the control station in real time;

and, at the control station, processing said data in real time for producing one or more reports based on the processed data.

The method may also include the step of causing each parking meter to continually sense whether a vehicle is parked in a parking position monitored by that parking meter and transmitting data relating to occupation of that parking position to the control station in real time.

The method may also include the step of causing the parking meter to print tickets,

infringements notices, or receipts for vehicles parked in a parking position monitored by that parking meter.

Preferably, parking meter configuration data stored in each parking meter may, from time to time, be updated by transmitting new configuration data from the control station via said communications network.

Preferred embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which like components or elements are indicated by like reference numerals.

Figure 1 is a block diagram of an embodiment of a parking management system;

Figure 2 is a further block diagram of the parking management system;

Figure 3 is a block diagram of a parking meter of the parking management system in accordance with the embodiment of Figure 1;

Figure 4 is a more detailed block diagram of the parking meter of Figure 3;

Figure 5 is a block diagram of the electronic funds transfer (EFT) components of the parking meter of the embodiment shown in Figure 3;

Figure 6 is a block diagram of a field programming device and a retrieval machine of the parking management system of Figure 1;

Figure 7 is a block diagram of system data flow of a parking management system in accordance with an embodiment of the present invention;

Figure 8 is a block diagram of the parking management system architecture;

Figure 9 is a flow diagram of a bay monitoring and initial detection procedure of the parking management system of an embodiment of the present invention;

Figure 10 is a flow diagram of a payment initiation procedure of the parking management system of an embodiment of the present invention;

Figure 11 is a flow diagram of a credit card payment procedure of the parking management system of an embodiment of the present invention;

Figure 12 is the first part of a flow diagram of a smart card (or stored value credit card) payment procedure of the parking management system of an embodiment of the present

invention;

Figure 13 is the second part of a flow diagram of a smart card (or stored value credit card) payment procedure of the parking management system of an embodiment of the present invention;

Figure 14 is the third part of a flow diagram of a smart card (or stored value credit card) payment procedure of the parking management system of an embodiment of the present invention;

Figure 15 is a flow diagram of an enforcement notification procedure of the parking management system of an embodiment of the present invention;

Figure 16 is a flow diagram of an internal monitoring and security procedure of the parking management system of an embodiment of the present invention;

Figure 17 is a data flow diagram of the vehicle detection procedure of the parking management system of an embodiment of the present invention;

Figure 18 is a data flow diagram of the smart card transaction procedure of the parking management system of an embodiment of the present invention;

Figure 19 is a data flow diagram of the EFT transaction procedure of the parking management system of an embodiment of the present invention;

Figure 20 is a data flow diagram of the internal monitoring and security procedure of the parking management system of an embodiment of the present invention;

Figure 21 is a data flow diagram of the enforcement notification procedure of the parking management system of an embodiment of the present invention;

A parking management system 2, as shown in Figures 1 and 2, includes a plurality of parking meters 12 connected to a control station 14 via communication networks having data communication links 16. The control station 14 includes a data processor 18, and a data communication interface 20. Each parking meter 12 can monitor one or more parking bays (Figure 2 shows each parking meter monitoring 5 parking bays). Sensors for detecting the presence of a vehicle in a parking bay in the form of vehicle presence detectors 24.1 to 24.N, as shown in Figure 4 (where N is the number of parking bays) are connected to an electronic controller 26 of the parking meter 12. Although other sensors are contemplated, not the least of which are those employing electromagnetic radiation, electromechanical sensors or magneto-

resistive sensors, only inductive loop vehicle detectors will be described hereafter. The vehicle presence detector can be located just below the road surface in the parking bay, and/or in the associated curb-side in the vicinity of the parking bay. More than one vehicle presence detector may be required per parking bay to satisfy banking requirements. With the use of more than one vehicle presence detector, the parking meter 12 can also determine the direction and rate of entry of a vehicle to the parking bay. Since the vehicle presence detectors 24.1 to 24.N are connected to the electronic controller 26 of the parking meter 12, providing a binary status indicator for the parking bay is a way of indicating the parking bay occupancy status.

The parking meters are inter-connected in parking meter communication systems 28.1, 28.2 and 28.3, shown in Figures 1 and 2. The parking meter communication system 28.1 may utilise a local network to connect a plurality of parking meters 12 to the local controller 83. The parking meter communication system 28.2 may utilise a local network to connect a plurality of parking meters 12 to the local controller 83, with the local network extended with the use of modems 82 (for example, to traverse a roadway). The local controller 83 in turn is connected to the data communication interface 20 of the control station 14 via modems 84. The parking meter communication system 28.3 may utilise a modem 74 to connect a plurality of parking meters to the data communication interface 20 of the control station 14. Since these systems are similar, only parking meter communication system 28.1 will be described hereafter.

As best shown in Figure 5, each parking meter 12 includes an electronic funds transfer (EFT) unit 105, the electronic controller 26, a keypad 107, display 108, multi-mode reader/writer 112 and an LED panel 109.

Each parking meter 12 has one or more doors (not shown) for allowing access to the inside of the meter housing and which are closed and locked during normal operation. A sensor 58, for determining whether the doors are open, is electronically connected to the electronic controller 26. This allows the system to check whether the doors are open due to vandalism or because of a routine maintenance check. A temperature sensor 64 and a timer 65, including a real time clock 66, are electronically connected to the electronic controller 26. The temperature sensor 64 is for providing temperature calibration to the LCD display 108 so as to obtain the best

display quality. An electronic coin/token validator 68 and a speaker/buzzer 57 is connected to the electronic controller 26 and a contact-less smart card transmitter/receiver 113 is connected to the EFT unit 105.

Power for the parking meter is connected to the electronic controller 26 by the power connecter 56, this power supply may include a battery with solar recharge and/or a mains supplied power feed. The power may also be distributed in a multi-core cable along with the parking meter communication system 28.1, 28.2, and 28.3.

Memory 72, connected to the electronic controller 26, is arranged to include a region 72.1 for storing program data for controlling operation of the meter, a region 72.2 for storing configuration data, a region 72.3 including fault condition flags and counters and a region 72.4 for storing operational data, such as the total amount of cash/tokens in the cash/token box and the number of coins/tokens of each denomination in the cash/token box, the number and value of fees processed by the EFT unit 105 and the number and types of cards processed by the EFT unit 105.

Also forming part of the system are a portable field programming device 90 and a portable retrieval machine 96. The field programming device 90 includes a controller having a data interface 92 and memory 94. The retrieval machine 96 includes a controller having a data interface 98 and memory 100. Both of these devices can be connected to the data processor 18 of the control station 14 or the electronic controller 26 of a parking meter 12. The field programming device 90 and/or the retrieval machine 96 may be in the form of a hand-held portable computer such as a Hewlett Packard HP 620LX.

The field programming device 90 is connectable to the data processor 18 of the control station 14 to receive programme data and/or configuration data and/or synchronised time data. The field programming device 90 may then be connected to the electronic controller 26 of a parking meter 12 to download and store data in the memory 72 of that parking meter. The retrieval machine 96 has a unique identity code stored in its memory 100. When connected to the electronic controller 26 of a parking meter 12, it is interrogated for the code. If the code corresponds to the

code stored in the memory 72 of the parking meter 12, predetermined data is loaded from the parking meter 12 into the retrieval machine 96. The data so received is loaded into the data processor 18 of the control station by subsequently connecting the retrieval machine 96 to the data processor 18.

A parking meter 12, with its vehicle presence detectors 24.1 to 24.N, is in communication with the control station 14 via the data lines 16. Data relating to the operation and status of each parking meter 12 may thus be communicated to the control station 14 for real-time or batch processing and control. Such data includes: data indicative of whether a parking bay 22.N is vacant or occupied by a vehicle, this data being generated by the vehicle presence detectors 24.N; data relating to the amount of cash/tokens received by the parking meter during a specified time period or the total amount of cash/tokens in the cash/token box 54; data relating to the card transactions conducted by the parking meter during a specified time period or the total amount of card transactions by the EFT unit 105; data relating to the results of diagnostic tests on the parking meter; or data indicating that a vehicle is parked in a parking bay 22.N during a time period which is not paid for.

The results of diagnostics tests performed on the individual parking meters 12, whether automatically initiated, initiated by the field programming device 90 or directly from the control station 14, are stored in memory region 72.3 and transmitted via the communication lines 16 to the control station 14 or other centralised venue to assist technicians in the maintenance of the meters 12. Memory region 72.3 stores a plurality of fault condition flags and associated fault condition counters. Together with the real time clock 66, the electronic controller 26 allocates time stamps to fault conditions detected. The fault condition counters count the number of times different fault conditions are detected. This data is then made available to the control station 14.

Configuration data is stored in the memory 72 of each parking meter 12. Such data may relate to card or EFT transaction characteristics, fee changes, operating hours, number of parking bays to be controlled by a parking meter, text to be displayed on display 56 or special days having special rates. Identity codes may be compiled by means of a configuration editor program resident in the data processor 18 at the control station 14 and sent via the communications lines

16, and loaded into the parking meters 12 to be stored in the configuration data region 72.2 of memory 72. In response to the real time clock 66, a parking meter 12 may be required to change on a specified day from an existing tariff table stored in region 72.2 to a new tariff table also stored in region 72.2. Tariff tables for specific groups like the disabled, local residents, shop owners, public transport workers and couriers may be loaded into the parking meters 12 to be stored in the configuration data region 72.2 of memory 72.

The EFT unit 105 has a memory 119 and is connected to the electronic controller 26. The electronic controller 26 passes data to the EFT unit 105 which may be loaded into an operational data part 117 of the EFT memory 119 and which may be displayed on display 108. The multi-mode card reader/writer 112 collects information from a user's card at the start or end of a transaction and stores it in the operational data part 117. The multi-mode reader/writer 112 can simultaneously or individually accept information from a multi-track magnetic stripe reader 111 and/or a integrated chip smart card reader/writer 110. A LED panel 109 and display 108 indicates when to insert or remove a card and displays information such as card or transaction error messages. Contact-less smart cards can also be processed by a contact-less smart card transmitter/receiver 113. The keypad 107 is used to enter the user's personal identification number (PIN) into the EFT unit 105, which is normally a banking requirement for debit card transactions. The keypad 107 may or may not be required for credit or stored value integrated chip smart card transactions or cash/token transactions.

The control station 14 may upload program data to the EFT unit 105 to be stored in a program part 114 of the EFT memory 119 via the communication link 16. Program data can also be transferred to the memory 72 of the electronic controller 26 by the data communication link 16 or the field programming device 90. The electronic controller 26 then transfers the program data to the program part 114. The field programming device 90 can transfer program data directly to the program part 114.

The control station 14 may also upload configuration data to the EFT unit 105 to be stored in a configuration part 115 of the EFT memory 119. Configuration data can also be transferred to the memory 72 of the electronic controller 26 by the data communication link 16 or the field

programming device 90. The electronic controller 26 then transfers the configuration data to the configuration part 115 via the EFT unit 105. The field programming device 90 can transfer configuration data directly to the configuration part 115.

The control station 14 can transmit or receive diagnostic data from the EFT unit 105 to be stored in a diagnostic part 116 of the EFT memory 119. Diagnostic data can also be transferred to and from the memory 72 of the electronic controller 26 by the data communication link 16 or the field programming device 90. The electronic controller 26 then transfers the diagnostic data to or from the diagnostic part 116 via the EFT unit 105. The field programming device 90 can also transfer diagnostic data directly to or from the diagnostic part 116.

The control station 14 can transmit or receive operational data to or from the EFT unit 105 and an operational part 117 of the EFT memory 119. Operational data can also be transferred to the memory 72 of the electronic controller 26 by the data communication link 16 or the field programming device 90. The electronic controller 26 can then transfer the operational data to the operational part 117 via the EFT unit 105. The field programming device 90 can transfer operational data directly to or from the operational part 117. The electronic controller 26 can transmit or receive operational data to or from the EFT unit 105. Operational data can relate to the text to be printed on the optional printer 55 or the status of the vehicle presence detectors 22.1 to 22.N.

The electronic controller 26 can determine the operational status of the EFT unit 105 and contents of the EFT memory 119.

During manufacture, the EFT unit 105 may be loaded with encryption programs stored in the EFT memory 119. Also, the EFT unit 105 can be loaded with a unique pad identification number and secret RSA encryption key and stored in the encryption part of the EFT memory 119. When the EFT unit 105 communicates on-line with a bank 103 for the first time, the EFT unit 105 registers with the bank's Key Initialisation Host to authenticate the pad identification number and secret encryption key stored in an encryption part 118. Once verified as the correct EFT unit 105, the bank 103 transfers the Digital Encryption Security (DES) key to the EFT unit

105 to be stored in the encryption part 118.

The vehicle presence detector 24.N identifies when a vehicle enters the parking bay 22.N and the electronic controller 26 commences timing with the timer 65. The parking meter 12 then awaits cash/tokens or card details and the display 56 or 108 directs the user to enter a card. A speaker/buzzer 57 may prompt the user to supply payment or payment details if he or she is slow to do so. The user enters cash or tokens into the coin/token validator 68 or card details into the multi-mode reader/writer 112 and, for debit card transactions, Personal Identification Number (PIN) details by the keypad 107. The card and PIN details are encrypted using the encryption algorithm in the program part 114 of the EFT memory 119 and the secret encryption keys stored in encryption part 118. The EFT unit 105 can process the transaction by one of two methods: firstly by exception-processing of invalid cards, whereby the transaction details associated with valid cards are stored in memory for later processing with the bank 103 or private label card issuing authority 104; secondly, the EFT unit 105 sends the message authentication code (ie. encrypted transaction details) to the electronic controller 26, which then transmits the parking meter details and message authentication code (MAC) to the control station 14 via the communication link 16. The control station then interfaces with the bank 103 or private label card issuing authority 104 to verify the details of the card and PIN details encrypted in the message authentication code.

The reloading of monetary or other values on stored-value cards (ie. smart cards or combination smart card and magnetic strip cards having a stored value on the card) can be processed by the parking meter 12 using the multi-mode reader/writer 112 and the EFT unit 105 over the communication links 16 with the control station 14, bank 103 or private label card issuing authority 104.

The parking meter 12 can use the communication links 16 with the control station 14 to redeem customer loyalty rewards held in the customer loyalty program 101 as an alternative method of payment.

If the card and PIN details are correct and the transaction is approved, the bank 103 or private label card issuing authority 104 transmits the approval for the transaction to the control station 14 which in turn transmits the approval to the EFT unit 105 via the electronic controller 26 and communication link 16. At the end of the period during which the vehicle is in a parking position, and immediately prior to departure, a user may end the transaction. If a printer 55 is installed, a receipt for the transaction can be requested and printed. If a receipt is requested, a grace period will be allowed to permit the user to return to the vehicle and drive it away. If the vehicle is not driven away before the expiration of the grace period, the charge is re-activated from the time of the commencement of the grace period, and the charging continues until either the vehicle is driven away, or a further request is made for a receipt. The fees will then be charged to the user's card account.

If the card or PIN details are incorrect or the transaction is not approved, the bank 103 or private label card issuing authority 104 transmits the disapproval for the transaction to the control station 14 which in turn transmits the disapproval to the EFT unit 105 via the electronic controller 26 and communication link 16 and the EFT unit 105 displays the decline of the transaction to the display 108.

If the bank 103 or private label card issuing authority 104 determines that a card may have been used fraudulently, the bank 103, private label card issuing authority 104, or control station 14 can notify the appropriate policing authority of the location and time where the alleged fraud took place, and whether the vehicle present in the parking bay 22.N at the time of the alleged fraud is still there.

When the vehicle presence detector 24.N identifies that a vehicle has departed the parking bay 22.N or if the parking arrangement is otherwise terminated, the EFT unit 105 calculates the total time the vehicle was in the parking bay and applies linear, and/or non-linear, and/or stepped tariffs to calculate the fee associated with parking in the parking bay for that period of time. Transaction details are then encrypted and the EFT unit 105 sends the message authentication code to the electronic controller 26. The electronic controller

26 then transmits the details of the parking meter 12 and message authentication code to the control station 14 via the communication link 16. The control station then interfaces with the bank 103 or private label card issuing authority 104.

Linear tariffs are those which are constant for each unit of time, eg. $20 per day or $6 per hour. Non-linear tariffs are those which increase or decrease the fee per unit of time over a longer period of time, resulting in a fee which exponentially increases or which asymptotically reaches a maximum. Stepped tariffs involve charging a base linear or non-linear charge and then charging an increased fee at a specified time. Stepped tariffs are used as the basis for levying fines for overstaying the paid time in the parking position.

Fees may also be calculated in terms of a base rate and a variable rate. These rates will be applicable over a base rate period and variable rate period respectively. During the base rate period, the fee will increment by a number of uniform fee units per uniform time unit. During the variable rate period, the fee rate may vary on a sliding scale per time unit.

The time units may be uniform or variable. A variable number of fee units may be able to be charged per time unit. The fee unit and the time unit is set to suit parking resource objectives of the parking authority 102 and may not be the same as those used in the base rate period. For example, with a base rate period of one hour, each time unit may be six minutes, and the base rate period fee unit 20 cents. The fee for occupying the bay for one hour would therefore be two dollars. During the variable rate period, the fee rate may be 40 cents per two minute time unit for the first 20 minutes, increasing to one dollar per 90 second time unit thereafter. In this example, the variable time rate therefore acts as a disincentive for users to leave their vehicle parked longer than the paid time but does not penalise them too harshly for an initial period of overstaying.

Locations and times may have designations such as "Parking permitted", "Parking restricted" or "Parking not permitted".

For example, "Parking permitted" means that any vehicle may park in the parking position

and pay the appropriate fee.

"Parking restricted" means that only certain classes of user may occupy the parking bay 22.N, for example, a resident with special parking rights, with or without a fee, who enters a special identification information into the meter 12.

"Parking not permitted" means that no vehicle is permitted to park in the parking position at any time while the "Parking not permitted" signal, in whatever fashion, is displayed.

The duration of a time block which will attract a set fee may be varied. For example, the chargeable time block may be set at seconds, minutes, hours, days, or multiples thereof. Once the vehicle remains in the parking position for part of the time block, the tariff chargeable will be a set monetary amount which will permit occupation of the parking position by that vehicle for the whole of the remaining time in that time block.

The control station 14 may also interface with customer loyalty programs 101 to facilitate earnings rewards for using the system. The control station 14 may also provide details on occupancy, faults, trends, damage, electronic funds transfer or other relevant information. Authorized organisations may be granted access to receive information to the extent that their authorization allows. The appropriate authorized municipality 102 may interface with the central control station to update, add, or modify control parameters for parking meters in their domain.

Data relating to the total amount of card transactions received by each parking meter 12 can be reconciled with the bank 103 or other card issuer 104 at the control station 14.

The electronic controller 26 of each parking meter 12 is adapted, upon a signal from the vehicle presence detector 24 that a vehicle is no longer present, to reset the timer 65, every time a vehicle leaves the parking bay 22.N, thereby increasing revenue from the parking meter 12 (because the next user will not be able to use unexpired time paid for by the previous user). Further, data indicating that a vehicle is parked in a parking bay 22.N

during a time period not paid for is accessible from the control station 14. This data may be used to direct the relevant policing authority to such a parking bay 22.N for further action.

If the card used to initiate the fee payment transaction is reinserted into the multi-mode card reader/writer 112 or the contactless smart card transmitter/receiver 113, the EFT unit 105 will then immediately calculate the total amount of fees owing and transmit it to the control station 14.

Data relating to the distribution of vehicles over a parking resource as a whole is accessible from the control station 14 at any time. Accordingly, vehicles may be routed to areas of the parking resource which are under-utilised. Alternatively, the standard or variable tariffs for parking areas of higher use may be increased and those for areas of lower use may be decreased. This would facilitate a more even distribution of vehicles over the parking resource and thus help to manage the parking resource more effectively.

Parking meter municipalities 102 can communicate with the control station 14 and via the data communication interface 20 so as to access data relating to parking resources they possess rights to. They may also upload into the data processor 18 new fee schedules, tariff changes or changes in the availability of particular parking meters 12 or bays 22.N.

All communications between the control station 14 and parking meters 12 take place over a communications network 16. The parking meters 12 effectively act as slaves to the data processor 18. A parking meter generally transmits data in response to being polled by the control station 14, local controller 83, when an EFT transaction is being processed or when a programmed event occurs in the parking meter 12.

The system 2 allows for a grace period during which a car may have been sensed as occupying a parking position but for which the user is not charged. This is to allow time for the user to approach the nearest meter, decide on a method of payment and enter either payment or payment information, after which entering, charges for use of the parking

position may accrue. If the user remains in the parking position 22.N longer than the grace period without entering a valid payment, the enforcement authority will be notified.

In the case of payment by cash or smart card, the whole of the period of the timed parking arrangement will have been pre-paid. In the case of payment by debit or credit card, the charge will be automatic on departure of the vehicle from the parking position. In the case of payment by debit or cred card, should the user require a receipt for the parking payment, the charge, and therefore the receipt, will cover the period of time up to the end of the current time block for that meter.

The system uses vehicle detection to charge a user from the time the vehicle enters to the time the vehicle exits the parking position, and allows the fees attributable to the whole period of use to be automatically debited to the user's account after the vehicle departs. Within the grace period after the vehicle arrives, the user nominates the account to be used by using a valid payment mechanism. Valid payment mechanisms include, but are not limited to, standard credit or debit cards incorporating a magnetic stripe and/or magnetic smart card or integrated chip card issued by recognized financial institutions participating in electronic funds transfer or other authorized private label card issuing authorities, as well as the redemption of customer loyalty rewards.

Figure 7 shows the data transfer relationships of the elements of the parking management system 2 (also referred to herein as an automatic parking management system (APMS)).

The data concentrator 83 (also referred to hereinbefore as local controller 83) provides a communications interface between the control centre 14 and each of a plurality of parking meter controllers 26 (also hereinbefore referred to as electronic controllers 26). The control centre 14 is configured to communicate with a number of data concentrators 83 at various locations. The control centre 14 provides a central interface 15 to facilitate operation and control of the system by a supervisor.

The parking meter controller 26 is located within the parking meter 12 and is in

communication with the EFT unit 105, local user interface (including keypad 107, display 108 and LED panel 109), internal sensors 58, 64 and vehicle detectors 24.

A transportable programming/retrieval device (being either one or both of the aforementioned field programming device 90 and milking machine 96 as shown in Figure 6) is adapted to interface with each of the control centre 14, data concentrator 83 and parking meter controller 26.

Figure 8

The Control Centre communicates with a number of Parking Meter Controllers in the field via the Local to Central Communications Link. It batches and transmits EFT transaction data to the Financial Clearing House.

The Control Centre:

- Alerts the Enforcement Authority of any violations.
- Maintains a historical records.
- Monitors alarm data.
- Performs hardware checks.
- Monitors by other elements of the system.

The Central Interface receives and displays prompts and alarms from the Control Centre, and allows the Supervisor to call up information and perform searches of its various databases as required. The Central Interface may also allow the input and dissemination of Fee Tables and other data within the APMS.

The Data Concentrator provides communications between a number of Parking Meter Controllers and the Control Centre. The Data Concentrator receives and stores batched data from Parking Meter Controllers.

A Parking Meter Controller located within each Parking Meter controls that meter via the

a local area network (LAN), and monitors and operates the following field devices:

•Internal Sensors

•User Interface

•Vehicle Detector

•EFT Unit

The Parking Meter Controller performs:

•Fee calculation

•Transmission of data to and from the User via the User Interface

•Transmission of data to the EFT Unit required to process a fee transaction

•Timing of the charging period

•Error checking and routing of encrypted transaction data from the EFT Unit to the Financial Clearing House

•General communications with the EFT Unit

Other functions of the Parking Meter Controller include:

•Real-time processing of the data from the vehicle sensors.

•Communication with the Data Concentrator (transmittal of batched data).

•Communication at asynchronous intervals with the Control Centre via the Data Concentrator (transmittal of alarm and violation alerts).

•Error checking of data transmitted and received. This may alternatively be carried out by the Communications Links.

•Diagnostics monitoring of field devices.

•Monitoring and reporting on the mechanical security of the Parking Meter Controller.

The EFT Unit is used by the Parking Meter Controller to process Credit Card and Smart Card transactions and encrypt the data for transmittal to the Financial Clearing House.

The User Interface provides information to the User via a display incorporating text and diagrams. The user may input data to the User Interface via a keypad. The keypad and display functions may be combined with those of the EFT Interface on one physical unit.

Each vehicle detector monitors the presence of vehicles in a particular parking bay controlled by the APMS. This information is transmitted to the Parking Meter Controller. If a detector is detected to have failed then the detection processor deems the car space to be vacant and immediately terminate any transaction.

The bay monitoring and initial detection procedure is shown in Figure 9.

The procedure begins with the bay empty at step 900.

Step 905. The parking bay is monitored for the presence of a vehicle.

Step 910. The presence/absence of a vehicle in the parking bay is registered.

Step 915. Timing of the parking duration of the vehicle is commenced.

Once the presence of a vehicle has been established, and the timing commenced, the Payment Initiation procedure is commenced at step 1005. Other procedures feed into the bay monitoring and initial detection procedure at step 905 as shown in Figure 9.

The payment initiation procedure is shown in Figure 10. This procedure ensures that:

- the Bay number is entered and is valid.
- The User selects the preferred Card payment option.
- A vehicle present in the parking bay either commences payment procedures or leaves.
- The Enforcement Authority is notified by the Control Centre of any vehicles not paying for parking.

The payment initiation procedure described below requires that the User carry out actions in the following logical sequence:

1. Park the vehicle in the bay
2. Enter the bay number into the User Interface
3. Select a payment option

Step 1005. A message prompting the User to enter a bay number is displayed on the User Interface. The other steps which feed into this step are shown in Figure 10.

Step 1010. The APMS determines if the User has entered the bay number.

Step 1012. A Grace Period is given to Users to complete payment initiation procedures.

If this period expires prior to payment initiation, the User is considered to be in violation of parking rules and the Enforcement Notification procedure is initiated at step 1500.

Step 1014. While the APMS waits for the bay number to be entered, it checks if the User exits the parking bay. If this happens before the end of the Grace Period, the procedure is cancelled at step 1050 and the Parking Duration is reset to zero.

Step 1015. The Bay Number entered by a User is checked for validity. This ensures that:

a) The number is a valid bay number for that parking meter;

b) The number of the bay which is entered is currently occupied by a vehicle.

Step 1017. If an invalid Bay Number is entered, an error message is displayed, and the User is prompted to enter the number again.

Step 1020. The APMS prompts the User to select their preferred payment option (Credit Card, Smart/Credit Card or Manual Cancellation of Parking ).

Step 1025. The APMS determines if the Credit Card option is selected. If so, the Credit Card Payment procedure is initiated at step 1105.

Step 1030. The APMS determines if the Smart/ Credit Card option is selected. If so, the Smart/ Credit Card Payment procedure is initiated at step 1200.

Step 1040. The APMS determines if the vehicle leaves the Parking Bay.

Step 1045. The APMS allows Users a Grace Period after parking their vehicle in a parking bay. This is to allow them to:

a) Identify the number of the Parking Bay they have parked in

b) Locate the Parking Meter

c) Initiate Payment procedures

Should the Grace Period be exceeded then the Enforcement Notification procedure is activated at step 1500.

Step 1050. If the vehicle has left the bay, the parking duration is reset to zero.

The credit card payment procedure is shown in Figure 11. When the User commences the Parking Period, the APMS will record and store the User's credit card details. When the parking period is concluded, the transaction is processed and stored for later batch transmission to the Financial Clearing House.

Processing of the Credit Card transaction may be initiated in three ways:

•The vehicle leaves the bay;

•The User re-enters the same card used to terminate the charge period;

•The vehicle exceeds the maximum parking period allowable.

The applicable Parking Fee is calculated on the basis of the total Parking Duration, with the Base Rate and Variable Rate components as required.

The parking duration is not set manually but is calculated automatically; based on when the vehicle leaves, the card is re-entered, or the vehicle exceeds the maximum parking period. Users can park to the end of the Base Rate Period (at the Base Rate) plus a Variable Rate Period (charged at the Variable Rate Fee). The end of the Variable Rate Period will constitute the effective time limit for parking when using a Credit Card to pay the fee.

At step 1105, the APMS verifies the validity of the credit card.

Step 1110. If the card is invalid, an error message is displayed and the card is rejected. The Payment Initiation procedure is activated at step 1005.

Step 1115. Details required may include:

- Bay Number
- Start time
- Card details
- Account details

Step 1120. The APMS monitors the Parking Bay.

Step 1125. If a vehicle leaves a parking space without swiping the credit card, the APMS determines if the vehicle leaves the Parking Bay.

Step 1130. The appropriate parking fee is calculated.

Step 1132. The information required by the APMS is stored for later transmission.

Step 1134. The parking duration for that parking bay is reset to zero, and the Bay Monitoring and Initial Detection procedure is initiated (step 905).

Step 1135. If the User exceeds the maximum allowable parking duration, the APMS determines if the maximum allowable parking duration has been exceeded.

Step 1140. The appropriate parking fee is calculated.

Step 1142. The information required by the APMS is stored for later transmission and the Enforcement Notification procedure is initiated (step 1500).

Step 1145. If the User re-enters the Credit Card used to set up the fee period, the APMS determines if the User entered the credit card used to set up the payment period.

Step 1150. The appropriate parking fee is calculated.

Step 1152. The information required is stored for later transmission.

Step 1155. A receipt is printed.

Step 1160. The APMS determines if the vehicle has left the parking bay.

Step 1165. The parking duration for that parking bay is reset to zero and the Bay Monitoring and Initial Detection procedure is initiated (step 905).

Step 1170. The APMS determines if payment procedures are initiated. If so, the Parking Initiation procedure is initiated (step 1105).

Step 1175. The APMS determines if a predetermined grace period has elapsed. If the grace period has elapsed, then and the Enforcement Notification procedure is initiated (step 1500).

Users can pay for parking fees using a combination Smart/Credit Card. The procedure for this payment method is shown in Figures 12, 13 and 14. The User parks the vehicle, keys in the Bay Number and swipes the Smart/Credit Card. The APMS deducts from the Smart Card element the Basc Rate Fee for the full Base Rate Period. The APMS records and stores the details of the Credit Card element needed to complete a Credit Card transaction as shown in Figure 11. Charging for the duration of the Base Rate Period is terminated in one of the following ways:

1. The User drives the vehicle away. If the User does not re-enter the Smart/Credit Card, the APMS retains the full amount deducted from the Smart Card element.
2. The User re-enters the Smart/Credit Card. As the Base Rate period has not ended, the APMS refunds the unused parking fee to the User, transferring the credit to the Smart Card element.
3. The vehicle remains in the bay beyond the end of the Base Rate period. The APMS ends the Smart Card charging and retains the full fee for the Base Rate Period. Charging for the Variable Rate Period is commenced (using the Credit

Card details).

Termination of charging for the Variable Rate period, and processing of the Credit Card Transaction, may proceed in any of the following ways:

1. The User drives the vehicle away. The APMS charges the Credit Card account at the Variable Rate for the period occupied.

2. The User re-enters the Smart/Credit Card. The APMS charges the Credit Card account at the Variable Rate for the Variable Period occupied, and prints a receipt. A period of grace is allowed for the User to vacate the bay, beyond which the Enforcement Notification procedure is initiated (step 1500).

3. The vehicle remains in the bay beyond the end of the Variable Rate period. The APMS charges the Credit Card account at the Variable Rate for the full Variable Rate Period. The Enforcement Notification procedure is initiated (step 1500).

The following is the procedure for the Smart Card payment component.

Step 1200. The APMS prompts the User to enter the Smart/Credit Card.

Step 1205. The APMS checks that the Smart/Credit Card is of a type accepted by the system and is a valid card.

Step 1210. An error message is displayed indicating that the Smart/Credit Card is not valid and the Payment Initiation procedure is re-initiated (step 1005).

Step 1215. The APMS reads the amount of credit available on the Smart Card element of the card, and determines if this is sufficient to pay for the Full Base Rate Period.

Step 1220. If not, a message is displayed to the User that insufficient funds remain on the card for this type of payment, and that the parking fee may be paid for exclusively with the Credit facility on the card.

Step 1225. The User indicates if they wish to use the Credit facility on the entered card. If so, the Credit Card Payment procedure is initiated (step 1105). If not, the Payment Initiation procedure is re-initiated (step 1005)

Step 1230. The valid payment amount is transferred from the Smart Card to the APMS.

Step 1235. Details are recorded. These may include:

- Bay Number
- Start time

· Card details

· Amount

Step 1240. Details are read from the card, recorded and stored.

Step 1300. The APMS monitors the Parking Bay.

If a vehicle leaves a parking space prior to the Smart Card credit being used up:

Step 1305. The APMS determines if the vehicle leaves the Parking Bay.

Step 1310. Excess credit is recorded.

Step 1312. Information required is stored.

Step 1314. The parking duration for that parking bay is reset to zero, and the Parking Initiation procedure is recommended (step 905).

The Following section applies if the User re-enters the Smart/Credit Card used to set up the Smart Card charging process.

Step 1315. The APMS confirms that the initial card used is re-entered.

Step 1320. The amount of unused credit is calculated.

Step 1322. The APMS transfers the unused credit to the Smart Card element of the card as a refund.

Step 1324. Information required is stored.

Step 1340. A receipt is printed.

Step 1345. The APMS determines if the vehicle has left the parking bay.

Step 1350. The parking duration for that parking bay is reset to zero and the Bay Monitoring and Initial Detection procedure is recommended (step 905).

Step 1355. The APMS determines if payment procedures are initiated. If so, the Parking Initiation procedure is initiated (step 1005).

Step 1360. The APMS determines if a predetermined grace period has elapsed. If the grace period has elapsed, the Enforcement Notification procedure is initiated (step 1500).

If the Smart Card credit is used up prior to the vehicle leaving the Parking Bay or the User cancelling the payment Period.

Step 1330. The APMS determines if the Smart Card credit has been used up (i.e the Base Rate Period is complete).

Step 1335. Fee Charging against the Credit Card element entered in (9) above is commenced.

Step 1400. The APMS monitors the Parking Bay.

If a vehicle leaves a parking space without swiping the Smart/Credit card.

Step 1405. The APMS determines if the vehicle leaves the Parking Bay.

Step 1410. The appropriate parking fee is calculated.

Step 1412. Information required is stored.

Step 1414. The parking duration for that parking bay is reset to zero, and the Bay Monitoring and Initial Detection procedure is recommended (step 905).

The following section applies if the User exceeds the maximum allowable parking duration.

Step 1415. The APMS determines if the allowable parking duration has been exceeded.

Step 1420. The appropriate parking fee is calculated.

Step 1422. Fee details and other information required by the APMS, Bank, etc are stored for later transmission and the Enforcement Notification procedure is initiated (step 1500).

If the User re-enters the Smart/Credit Card used to initiate the fee period:

Step 1425. The APMS determines if the User entered the Smart/Credit card used to initiate its free period.

Step 1430. The fee is calculated.

Step 1432. Information required is stored.

Step 1435. A receipt is printed.

Step 1440. The APMS determines if the vehicle has left the parking bay.

Step 1445. The parking duration for that parking bay is reset to zero and the Bay Monitoring and Initial Detection procedure is recommended (step 905).

Step 1450. The APMS determines if payment procedures are initiated. If so, the Parking Initiation procedure is initiated (step 1005).

Step 1455. The APMS determines if a predetermined grace period has elapsed. This allows the User to complete payment procedures, receive the receipt, and leave the parking bay. If the grace period has elapsed, then and the Enforcement Notification procedure is initiated (step 1500).

The enforcement notification procedure is shown in Figure 15:

Step 1500. Having identified that a vehicle is in violation, the APMS may send Parking violation data to the appropriate Enforcement Authority.

Step 1505. The APMS continues to monitor the bay (in violation).

Step 1510. The APMS continues to record the time of overstay.

Step 1515. The User may leave the parking bay before any Enforcement actions are initiated.

Step 1520. If so, the parking duration for that bay is reset to zero, and the APMS resumes monitoring the empty bay. The records of the overstay may be retained by the APMS if required.

Steps 1525, 1530. To process a violation, the APMS advises the Enforcement Authority that nominated parking locations are in violation.

The internal monitoring and security procedure is shown in Figure 16:

Step 1600. System operations are monitored. These involve the receiving, transmission, storage, processing and display of data. Records are retained for later review.

Step 1605. An error is registered in the operation of the APMS

Step 1610. The physical integrity of the APMS is monitored. By physical sensors.

Step 1615. A fault in the physical integrity of the APMS is detected.

Step 1620. The current status of the various subsystems within the APMS is recorded.

Step 1625. The system status is transmitted to the Control Centre.

Step 1630. It is determined whether this is a previously reported fault, or is new.

Step 1635. The new fault is recorded.

Step 1640. The fault data is transmitted to the Control Centre.

Step 1645. The continuance of an existing fault is recorded

Step 1650. The continuance of the existing fault is transmitted to the Control Centre.

The vehicle detection data flow is shown in Figure 17:

Step 1700. The presence or absence of a vehicle in a parking bay generates a response in the vehicle detector installed in that bay.

Step 1705. The sensor response is transmitted asynchronously from the Vehicle Detector to the Parking Meter Controller that controls that bay. This information is preferentially

conveyed by means of a physical wireline circuit between the detector and the Parking Meter Controller.

Step 1710. The sensor response is registered by the PMC that controls that bay. This data is used by the PMC to calculate the Parking Duration for the vehicle, and to generate a parking record (Parking Data) for that bay.

Step 1715. Parking data is batch transmitted to the Data Concentrator as required. This data is preferentially conveyed using a packet radio network designed for handling frequent small transactions. The protocols shall use Cyclic Redundancy Code (CRC) checking and error detection appropriate to the data radio network selected for the area. Alternatively, the information can be conveyed to the Data Concentrator by physical wireline using low speed modems. Alternatively the information can be conveyed over a TCP/IP Local Area Network using multidrop fibre optic links.

Step 1720. As the transmittal time requirements between this device and a) the PMC and b) the Control Centre may be different, this device shall be capable of storing and rebatching batched data received from the PMC devices, prior to forwarding it to the Control Centre. The Data Concentrator does not perform any data manipulation or conversion but acts as a data router with appropriate storage. Preferentially the Data Concentrator is provided with an Intelligent Data Switch capable of concentrating packets of data.. Such data packets would contain all information concerning a specific transaction including ID, address and CRC code.

Step 1725. Parking Data is batch transmitted to the Control Centre preferentially via a packet radio network. The protocols shall use CRC checking and error detection appropriate to the data radio network selected for the area. Alternatively the information can be conveyed via dial-up or fixed wireline services using modems appropriate to the line speeds available in the area. Preferentially such data rates shall be a minimum of 28.8 KB/sec.

Step 1730. The Control Centre stores and maintains a current "picture" of the whole system, for the purposes of system monitoring, and generating a Parking History for the areas controlled by the system.

Step 1735. Data held and generated by the Control Centre may be transmitted to the Central Interface asynchronously as required by the Supervisor. Preferentially this

information shall be conveyed using fixed wireline services using modems appropriate to the line speeds available in the area. For very large installations ISDN links can be provided to meet the service response times needed to meet operational requirements. Such services shall use CRC checking and error detection to maintain system data integrity. Alternatively fibre optic links can be used in place of wireline services. Alternatively information can be conveyed over a TCP/IP Local Area Network using fibre optic or twisted pair links depending upon the separation of the Control Centre and the Central Interfaces.

Step 1740. The Central Interface will display system data as required. This may include a current "snapshot" of the system, system history and other data as required. The Central Interface must be able to display prompts and receive input from the Supervisor. This interface may also include links to other organisations (such as the Enforcement Authority) and field operatives (such as the Technician or Operator) to enable the accessing of information, and transmission of fault alarms and data, enforcement information etc.

The EFT transaction data flow is shown in Figure 18:

Step 1800. The User enters a Credit Card into the EFT Interface. This device reads off identification data and any other data required by the APMS or Financial Clearing House to process the transaction. This device also carries out any checksum or other accuracy or security procedures. The Card Reader may temporarily store data for use with checksum or other procedures.

Step 1805. Card data and error checking data is transmitted asynchronously between the EFT Interface and the EFT Unit. Security measures, such as encryption or use of dedicated lines, may be used as required.

Step 1810. If required, the Receipt Printer prints a receipt of the transaction using the data provided by the EFT Unit.

Step 1815. Receipt data is transmitted asynchronously from the EFT Unit to the Receipt Printer.

Step 1820. The EFT Unit identifies and verifies the card and generates data to be printed on the receipt. Credit transfer data to be sent to the Financial Clearing House may be

encrypted prior to being sent.

Step 1825. Data is transferred between the EFT Unit and the Parking Meter Controller asynchronously. Security measures, such as encryption or use of dedicated lines, may be used as required.

Step 1830. The User Interface receives and transmits data and instructions to and from the User. The User Interface may temporarily store data for use with checksum or other procedures.

Step 1835. Data is transmitted between the User Interface and the Parking Meter Controller (asynchronously) as required. Security measures, such as encryption or use of dedicated lines, may be used as required.

Step 1840. The Parking Meter Controller performs calculations and stores data based on information received from the Card Reader and User Interface. The PMC is the primary source of transaction timing and will be periodically checked for accuracy by the Control Centre. Preset fee tables are also used that are stored by the Parking Meter Controller. This device transmits the transaction records, as well as encrypted transaction data to the Control Centre.

Step 1845. Data transmitted to the Data Concentrator is not required for response time to the User. As such, this data may be sent in batch form, at times that suit the economic and operational requirements of the system. Security measures, such as encryption or use of dedicated lines, may be used as required.

Step 1850. The Data Concentrator receives batched data from a number of Parking Meter Controllers. This data may be immediately batch transmitted to the Control Centre, or may be stored and compiled for batch transmission at a different schedule that suits the economic and operational requirements of the system

Step 1855. Data is batch transmitted between the Data Concentrator and the Control Centre.

Step 1860. The Control Centre compiles a Transaction History from the Transaction Records. It also assembles encrypted Transaction Data for batch transmission to the Financial Clearing House.

Step 1865. Data is transmitted between the Control Centre and the Central Interface (asynchronously) as required.

Step 1870. The Central Interface displays the Transaction History, and displays and receives instructions and prompts to and from the Supervisor.

Step 1875. Transaction Data is batch transmitted at regular intervals to the Financial Clearing House. The results of these transactions may be transmitted back to the Control Centre at regular intervals as required. Security measures, such as encryption or use of dedicated lines, may be used as required.

Step 1880. The Financial Clearing House processes the transaction data and provides credit to the various municipalities, authorities, etc., as required. This aspect of the operation is outside the scope of the APMS.

The internal monitoring and operational status data paths are shown in Figure 19.

This section covers the flow of information generated by the System Monitoring and Operational Status procedures. In general these take the form of:

· Physical sensors, whose output can be directly monitored. This includes the vehicle detectors, door sensors, thermometer etc.

· System devices, which can transmit a "heartbeat" at regular, predefined intervals to confirm their functionality and the integrity of the communication line.

· Fault Notification. This data is generated as a result of a fault being detected by a device, and transmitted to the Control Centre. This may be triggered by a missing "heartbeat" signal or other fault that a particular device is designed to detect.

· System operations records, generated by various system devices as a record of the processes, transactions, faults detected etc and transmitted to a central point (the Control Centre) for storage and review.

The paths that this data takes are described in Figure 19. The individual processes are as follows:

Steps 1900, 1905, 1910, 1915. Each peripheral device transmits either a continuous signal or a "heartbeat" signal to the Parking Meter Controller. Some signals go via an intermediary device, depending on the normal communication paths used. Those intermediary devices may be able to register faults and notify the Parking Meter Controller. The intermediary devices also provide heartbeat signals on their own.

Step 1920. The Parking Meter Controller collects and collates the various signals

received. If a fault is detected, fault notification is transmitted asynchronously to the Control Centre (via the Data Concentrator). The system monitoring data received by the Parking Meter Controller also is collated into the Operations Record, which is transmitted as a batch at regular intervals to the Control Centre.

Steps 1925, 1930, 1935. In general, batch data is transmitted at regular intervals from the Parking Meter Controller to the Control Centre. However, fault notification may be required to be transmitted as soon as it is detected.

Steps 1940, 1945, 1950. The Control Centre stores and collates the data received into the System History databases. The Supervisor is notified of any faults that are detected via the Central Interface, and can access the System History to display more data if required.

The enforcement notification data flow is shown in Figure 20:

Step 2000. The Parking Meter Controller registers a parking violation, as part of its parking monitoring activities.

Step 2005. The violation data is transmitted immediately (asynchronously) to the Data Concentrator.

Step 2010. The Data Concentrator routes the data through to the Control Centre. Data may be stores temporarily for the purposes of error checking.

Step 2015. The violation data is transmitted immediately (asynchronously) to the Control Centre.

Step 2020. The Control Centre registers the violation and enters it into its Violation History database. The Control Centre then generates a Violation Alert for the relevant Enforcement Authority. The form of this transmittal will depend on the requirements of the authority.

Steps 2025, 2030. The Violation alert and violation data is transmitted to the Enforcement Authority in a prearranged format. The authority may respond with a message confirming reception of the data and/or that action has been carried out.

**Glossary of terms**

APMS

Automatic Parking Management System. This refers to the electronic devices and associated processes defined in this document.

Base Rate Period

The time period during which a vehicle parked in a bay attracts a Base Rate parking fee. This period commences when the vehicle enters the bay.

Control Centre

The central point for the administration and control of the APMS by the Supervisor.

Credit Card

This refers to any card used to facilitate the transfer of funds or credit stored remotely. For the purposes of this specification, this term refers to the Credit Card ability of a particular card, as some cards may be able to perform Credit Card, Charge Card and Smart card functions. See also the definition of Smart Card below.

EFT

Electronic Funds Transfer. This includes any credit card, debit card or charge card transaction in which funds are not transferred immediately in real time from the account of the customer to the account of the merchant.

EFT Fee Processing

For the purposes of this specification, this refers to the calculation of the applicable parking fee to be charged, and transmission of the fee and EFT data to the Control Centre, for later batched transmission to the Financial Clearing House.

EFTPOS

Electronic Funds Transfer Point of Sale system. In these transactions, the account of the customer is immediately debited. These transactions always require a PIN number to be keyed in and they never require a signature. Verification of card details is done in

real time.

EFT Transaction Initiated

This refers to the initial entry of an EFT card through the card reader that prompts the storage of the EFT data and commencement of the EFT charge period.

Enforcement Authority

The entity with the responsibility of enforcing penalties for parking violations on behalf of the Parking Authority.

Financial Clearing House

The entity responsible for the collection and distribution of fees collected by the APMS, normally expected to be a bank.

Fine, penalty

The fee to be charged to a user in cases of a parking violation by that user.

GST

Goods and Services Tax

Grace Period

In general, this refers to the period between the initiation and the implementation of a particular function that allows time for an action or actions to be carried out. For example, Users are allowed a Grace Period after parking their vehicles to allow them to locate the relevant Parking Meter and initiate payment, prior to being considered in Violation (see below). There are several Grace Periods used by the APMS, and separate descriptions of these are given in the text of this document as they occur.

Parking Authority

The ultimate body responsible for the control and regulation of parking in the area. This may be a local government body or the owner or manager of the parking resource and

may include the enforcement authority.

Smart Card

This refers to any card having funds stored on the card itself. For the purposes of this specification, this term refers to the "Smart Card" ability of a particular card, as some cards may be able to perform both Smart and Credit card functions.

Special Vehicle

Vehicles accorded special parking rates, times and times etc. These may be council vehicles, courier vehicles, vehicles of local residents and others where special parking rates and/or times have been pre-arranged with the Parking Authority. For the purposes of this specification it is assumed that the status of special vehicles is to be determined from a coded card which can be read by the card reader.

Supervisor

The person responsible for the day-to-day operation of the APMS from the Control Centre.

User

The person who pays for the use of a parking bay, typically a member of the public who has parked his or her vehicle in the bay.

User Interface

The keypad and display to allow the user to communicate with the APMS.

Transportable Programming/Retrieval Device (TPRD)

A portable device used by field operatives for maintenance and repair activities. It may upload/download data from field devices, perform checks, change equipment settings etc.

Variable Rate Period

The time period during which a vehicle parked in a bay attracts a Variable Rate parking fee. The rate may be higher than the Base Rate fee, and may increase over time. This reflects the maximum time period the Parking Authority wishes a vehicle to remain in the bay, as remaining in the bay for longer than this will be considered a violation.

Violation, infringement

A violation of the parking regulations as defined by the Parking Authority. In the context of the APMS, this is usually when a User is occupying a Parking Bay and has not paid the appropriate parking fee, or is over the maximum Period of Occupancy defined for that Bay. The determination and collection of fines for violations are the responsibility of the Enforcement Authority, and is outside the scope of operation of the APMS

CLAIMS:

1. A parking management system including:

sensing means for sensing the presence of a vehicle in a parking position;

a housing module having:

communication means for communicating with a network;

transaction means, in communication with the communication means and accessible to a user of the system, adapted to process data to effect a payment; and

processing means, in communication with the transaction means for monitoring the sensing means and for determining the payment for an overall time period during which the presence of the vehicle is sensed;

wherein the payment is determined according to a variable fee structure applicable to the overall time period and is effected at the end of the overall time period.

2. A parking management system according to claim 1, wherein the variable fee structure includes a base charging rate and a variable charging rate, the base charging rate being applicable for a first time period and, if the vehicle is sensed longer than the first time period, the variable charging rate being applicable for a second time period after the first time period.

3. A parking management system according to claim 2, wherein the overall time period is equal to the sum of the first and second time periods.

4. A parking management system according to claim 2 or 3, wherein the base charging rate is constant over the first time period and the variable charging rate changes over the second time period.

5. A parking management system according to claim 4, wherein the variable charging rate increases over the second time period.

6. A parking management system according to claim 1, wherein the overall time period is the period of time between an initial receipt of payment information and receipt by the processing means of a user-actuated parking termination signal.

7. A parking management system according to claim 6, wherein the user-actuated parking termination signal is actuated by the user, either by providing a termination instruction to the processing means through the transaction means, or by moving the vehicle out of the parking position and thereby causing the sensing means to cease to detect the presence of the vehicle in the parking position.

8. A parking management system according to claim 6, wherein if the presence of the vehicle is sensed after a grace period before or after the overall time period, the processing means is adapted to communicate an infringement signal to an enforcement body over the network.

9. A parking management system according to claim 8, wherein a nil charging rate is applicable during the grace period.

10. A parking management system according to claim 1, wherein the sensing means is adapted to sense the presence of one or more vehicles in respective one or more parking positions.

11. A parking management system according to claim 10, wherein the sensing means includes at least one induction coil for each parking position.

12. A parking management system according to claim 1, wherein the housing further includes display means for displaying information to the user, in communication with the processing means.

13. A parking management system according to claim 12, wherein the transaction means includes card reading means for reading credit card information and manual input

means for receiving an authorisation code from the user.

14. A parking management system according to claim 13, wherein if the user inputs a special vehicle authorisation code into the transaction means, a nil charging rate is applicable for at least a part of the overall time period.

15. A parking management system according to claim 12, wherein the transaction means includes cash payment means for receiving cash payment.

16. A parking management system according to claim 12, wherein the transaction means includes card reading means for reading stored-value card information and manual input means for receiving a payment authorisation code from the user.

17. A parking management system according to claim 13, wherein the communication means is adapted to communicate with a financial institution for determining whether the authorisation code is valid and whether there is sufficient credit available to the user to effect the payment.

18. A parking management system according to claim 17, wherein the communication means is in communication with a central control station, the central control station being adapted to receive operational information and financial transaction information from the processing means over the network.

19. A parking management system according to claim 1, wherein the processing means includes memory means.

20. A parking management system according to claim 19, wherein the system further includes a transportable programming device adapted to interface with the processing means for reconfiguring thereof and for reading and writing data from and to the memory means.

21. A parking management system according to claim 20, wherein the memory means includes further memory means for storing system configuration data, the control station being adapted to selectively change the configuration data stored in the further memory means.

22. A parking management system according to claim 20, wherein the programming device is also adapted to interface with a data processing means of the central control station.

23. A parking management system according to claim 1, wherein the transaction means includes means for sensing when an access door to internal components of the housing has been opened.

24. A parking management system according to claim 19, wherein the system further includes diagnostic means for performing diagnostic inspection thereof.

25. A parking management system according to claim 24, wherein the diagnostic means of each parking meter includes fault-condition monitoring and counting means for fault monitoring and storing fault-related data.

26. A parking management system according to claim 25, wherein the diagnostic means is controlled by the processing means and is adapted to transmit the fault-related data to the control station through a communications network.

27. A parking management system according to claim 1, wherein the housing further includes printing means for printing a receipt for payment.

28. A parking meter, including:

sensing means for sensing the presence of a vehicle in a parking position;

a housing module having:

communication means for communicating with a network;

transaction means, in communication with the communication means and accessible to a user of the system, adapted to process data to effect a payment; and

processing means, in communication with the transaction means for monitoring the sensing means and for determining the payment for an overall time period during which the presence of the vehicle is sensed;

wherein the payment is determined according to a variable fee structure applicable to the overall time period and is effected at the end of the overall time period.

29. A parking management system including a plurality of parking meters according to claim 28.

30. A parking management system according to claim 29, wherein the communication means of each parking meter is in communication with a central control station, the central control station being adapted to receive operational information and financial transaction information from the processing means of each parking meter over the network.

31. A parking management system according to claim 29, wherein each parking meter is in communication with one or more local controllers, each of which is in communication with a central control station, the central control station being adapted to receive operational information and financial transaction information from the processing means of each parking meter via the one or more local controllers.

32. A method for effecting payment for parking, including the steps of:

monitoring a presence signal, representative of the presence or absence of a vehicle, from at least one parking bay;

receiving payment information from a user of said parking bay which enables a payment;

selecting at least one charging rate, of a plurality of charging rates, applicable over at least one respective charging period;

determining a length of time said vehicle is present in said at least one parking bay in response to the presence signal;

determining the payment based on the selected said at least one charge rate applicable over the length of time; and

effecting the payment.

33. A method for managing a parking system, including the steps of:

sensing the presence or absence of a vehicle in a parking position;

selecting one or more fee charging rates from a plurality of fee charging rates applicable under one or more circumstances of use of the system;

receiving payment information relating to the payment of fees and authorisation thereof by a user of the system;

establishing a start time from which fees may be charged, the establishing of said start time being responsive to the sensing of the presence of said vehicle in said parking position;

establishing a finish time beyond which fees will not be charged, the establishing of said finish time being responsive to a timing termination signal actuated by said user;

calculating fees to be received from said user based on said one or more fee charging rates applicable under said one or more circumstances of use between said start time and said finish time;

using said payment information to effect receipt of a payment from said user based on said calculated fees.

34. A method of managing a parking resource including a plurality of parking positions, the method including the steps of:

providing one or more parking meters according to claim 28 to monitor utilisation of the parking positions;

providing a connection to each parking meter, through a communications network, to a control station having processing means;

causing each parking meter to regularly perform self-diagnostic tests and to store data relating to those tests;

causing each parking meter to store operational data relating to payment transactions performed by that parking meter;

causing the parking meters to transmit the data relating to the self-diagnostic tests or the operational data to the control station in real time;

and, at the control station, processing said data in real time for producing one or more reports based on the processed data.

35. A parking management system according to claim 4, wherein the variable charging rate decreases over the second time period.

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**Published**
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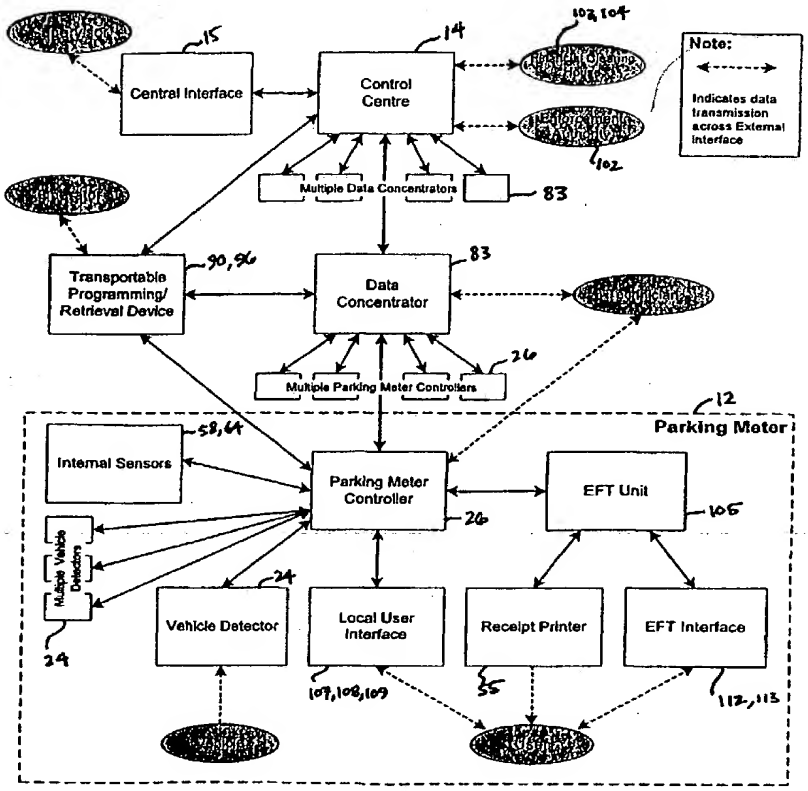
**(54) Title:** A PARKING MANAGEMENT SYSTEM

**(57) Abstract**

A parking management system includes: sensing means (24) for sensing the presence of a vehicle in a parking position; a housing module (12) having: communication means (26, 83) for communicating with a network; transaction means (105, 107, 112), in communication with the communication means and accessible to a user of the system, adapted to receive payment for an overall time period in which the presence of the vehicle is sensed, and processing means (26) for monitoring the sensing means (24) and for determining the payment according to a variable fee structure, the processing means (26) being in communication with the communication means (83) and the transaction means (105, 107).



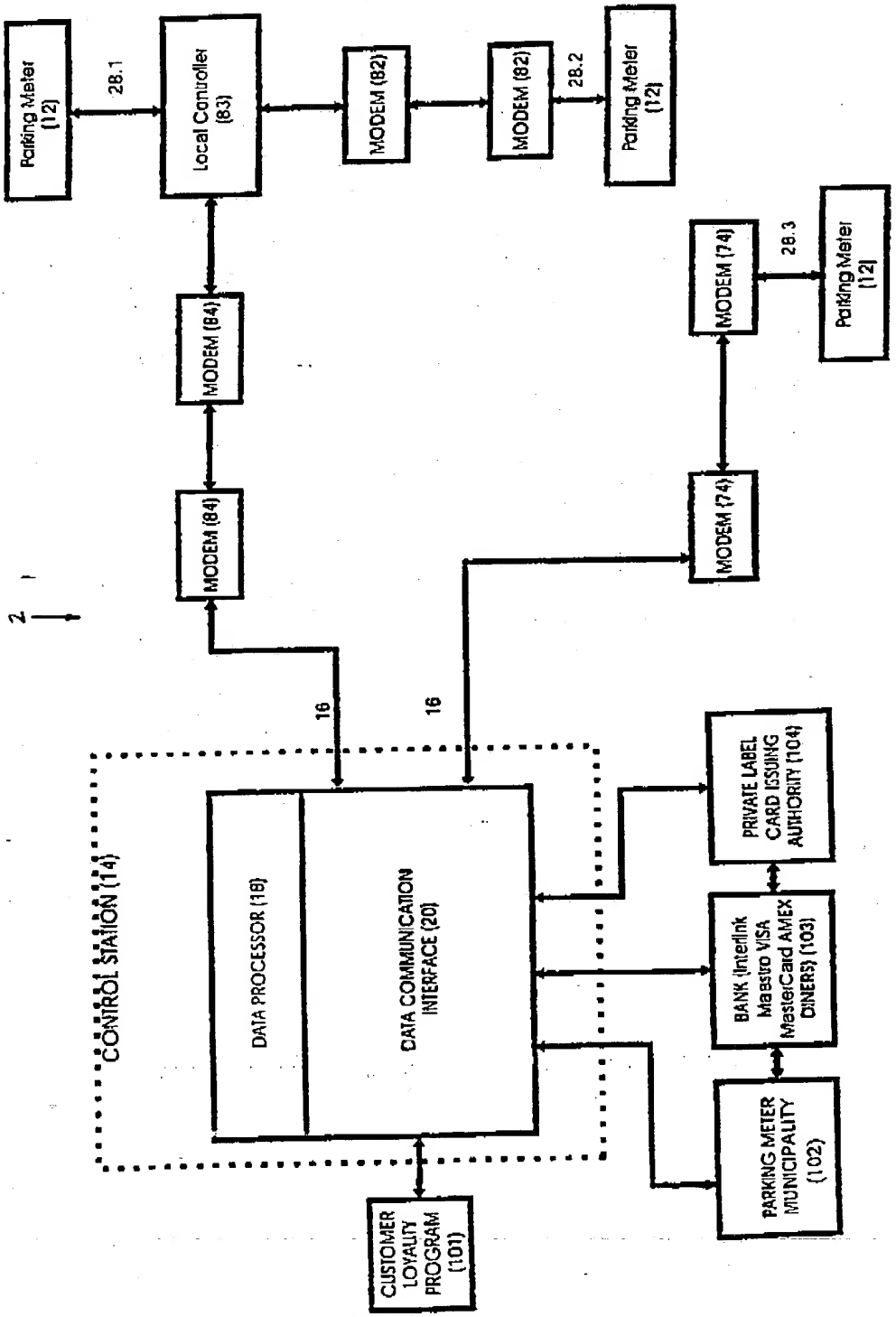

Parking Meter (12)
28.1
Local Controller (83)
MODEM (82)
MODEM (82)
28.2
Parking Meter (12)
MODEM (84)
MODEM (74)
28.3
Parking Meter (12)
MODEM (84)
MODEM (74)
2
16
16
CONTROL STATION (14)
DATA PROCESSOR (18)
DATA COMMUNICATION INTERFACE (20)
PRIVATE LABEL CARD ISSUING AUTHORITY (104)
BANK (Interlink Maestro VISA MasterCard AMEX DINERS) (103)
PARKING METER MUNICIPALITY (102)
CUSTOMER LOYALITY PROGRAM (101)

FIGURE 1

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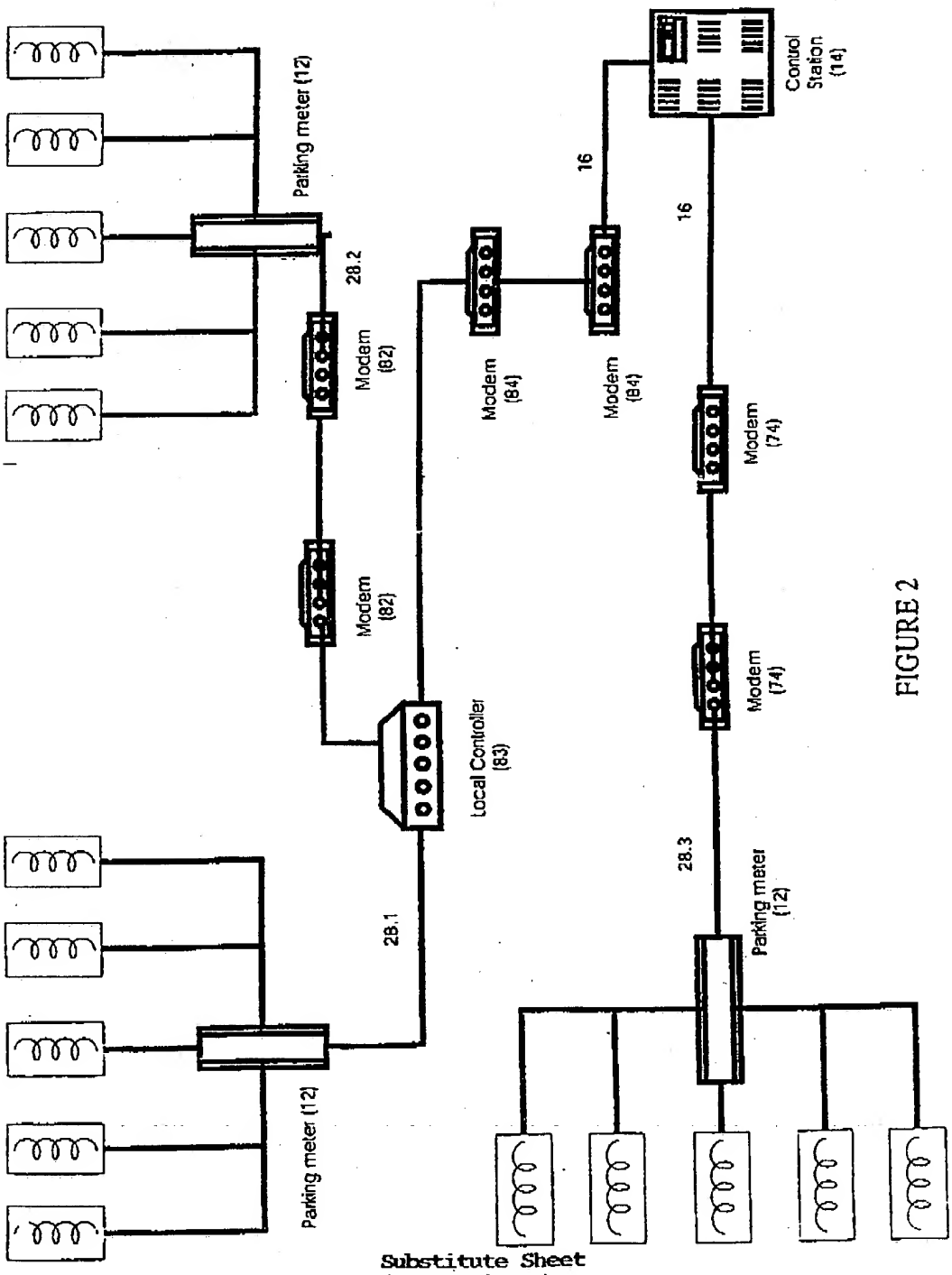



FIGURE 2

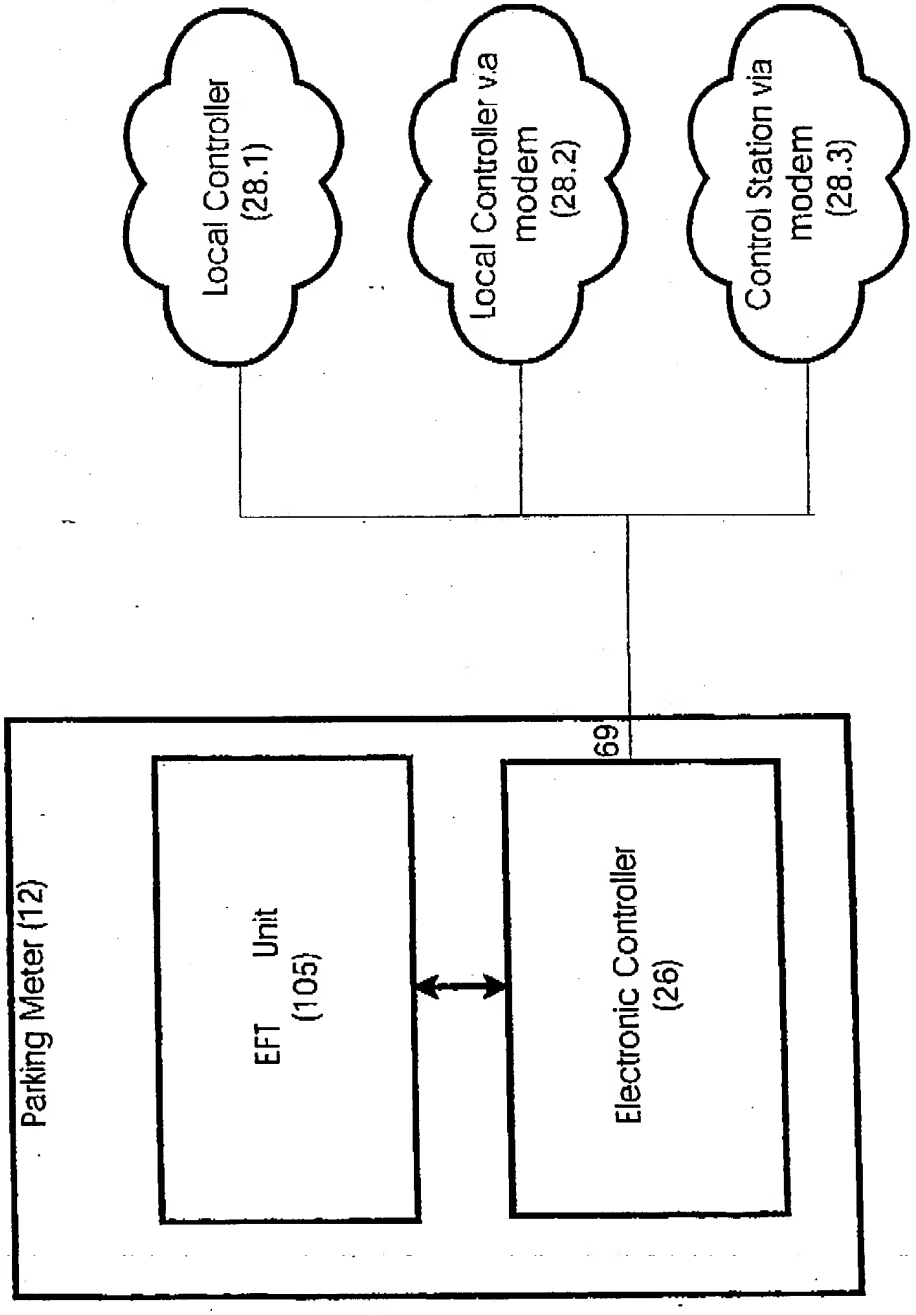

Local Controller (28.1)
Local Controller via modem (28.2)
Control Station via modem (28.3)
69
Parking Meter (12)
EFT Unit (105)
Electronic Controller (26)

FIGURE 3

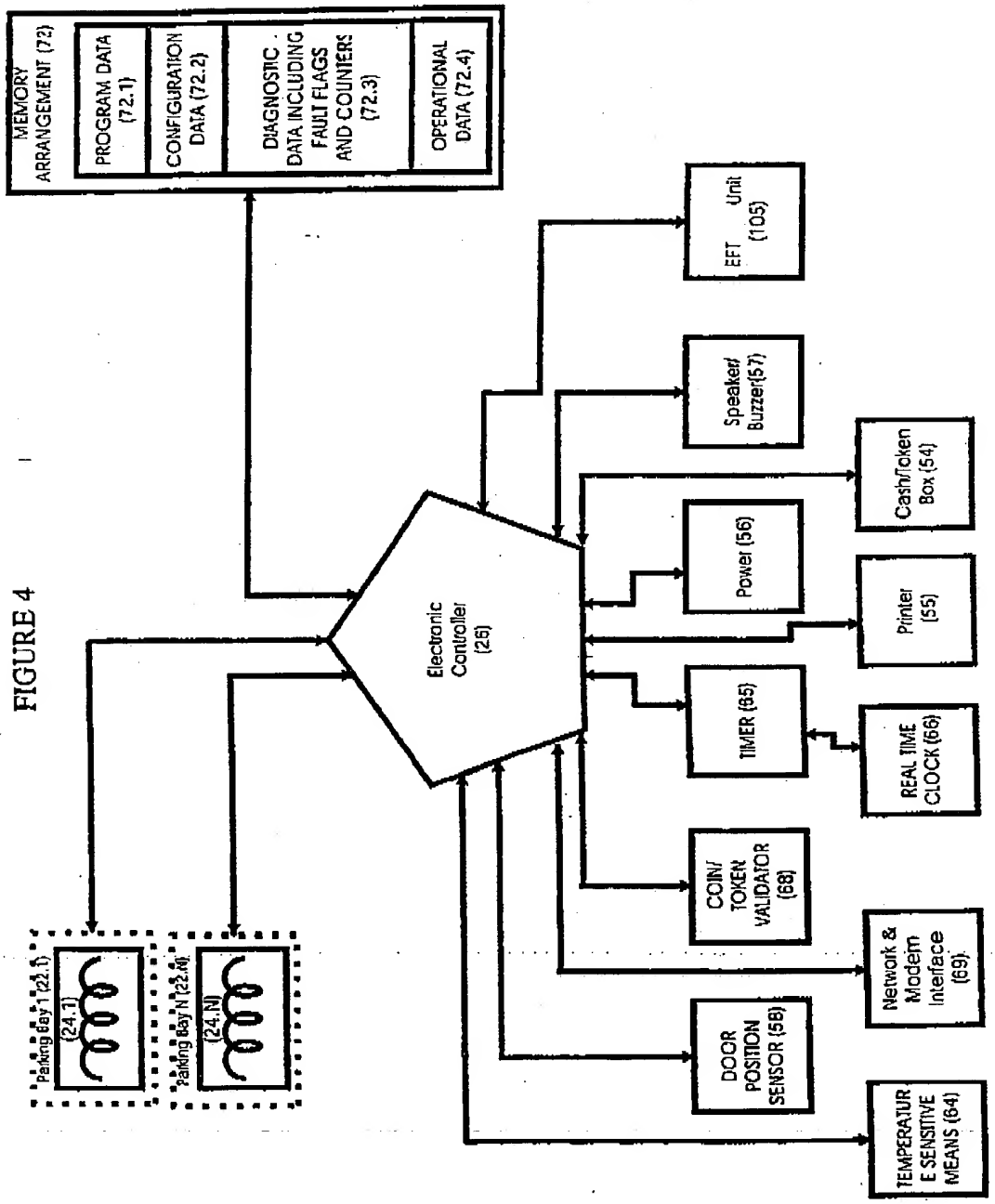

MEMORY ARRANGEMENT (72)
PROGRAM DATA (72.1)
CONFIGURATION DATA (72.2)
DIAGNOSTIC DATA INCLUDING FAULT FLAGS AND COUNTERS (72.3)
OPERATIONAL DATA (72.4)
Electronic Controller (26)
EFT Unit (105)
Speaker/ Buzzer(57)
Cash/Token Box (54)
Power (56)
Printer (55)
TIMER (65)
REAL TIME CLOCK (66)
COIN/ TOKEN VALIDATOR (68)
Network & Modem Interface (69)
DOOR POSITION SENSOR (58)
TEMPERATURE SENSITIVE MEANS (64)
Parking Bay 1 (22.1)
(24.1)
Parking Bay N (22.N)
(24.N)

FIGURE 4

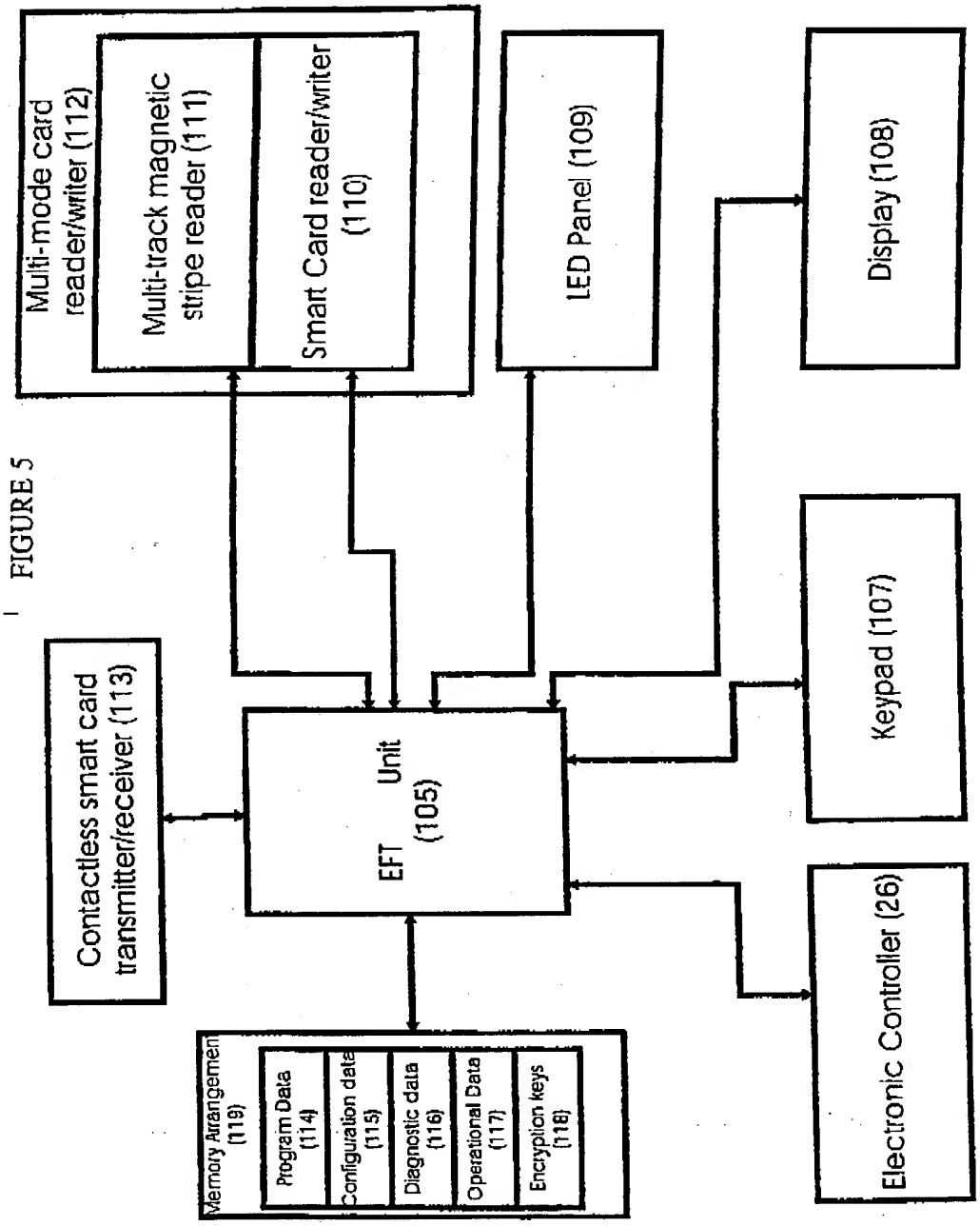

Multi-mode card reader/writer (112)
Multi-track magnetic stripe reader (111)
Smart Card reader/writer (110)
LED Panel (109)
Display (108)
Keypad (107)
Contactless smart card transmitter/receiver (113)
EFT Unit (105)
Electronic Controller (26)
Memory Arrangemen (119)
Program Data (114)
Configuration date (115)
Diagnostic data (116)
Operational Data (117)
Encryption keys (118)

FIGURE 5

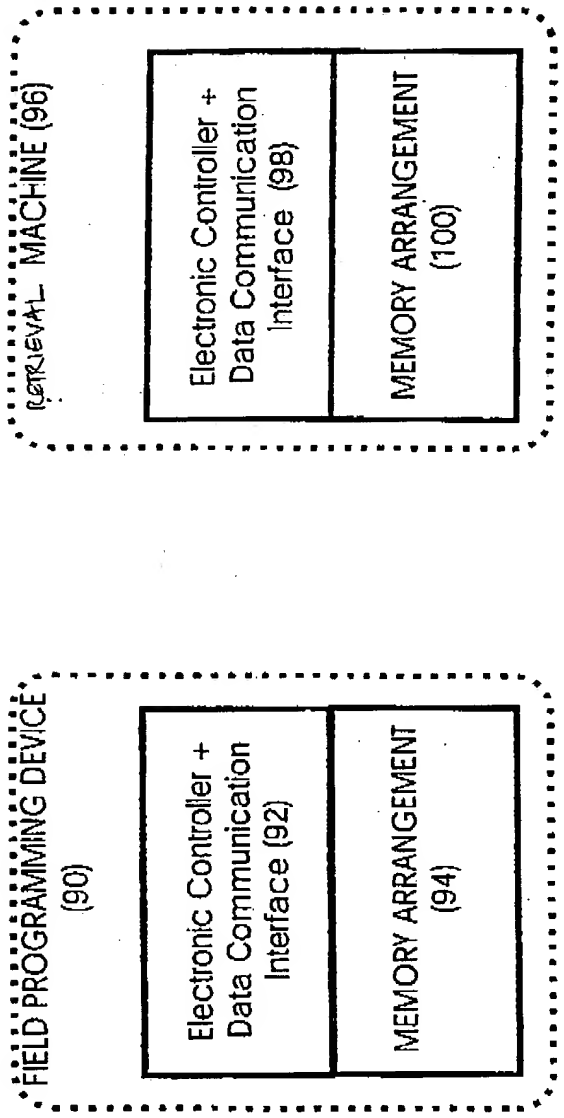

REMOTE RETRIEVAL MACHINE (96)
Electronic Controller + Data Communication Interface (98)
MEMORY ARRANGEMENT (100)
FIELD PROGRAMMING DEVICE (90)
Electronic Controller + Data Communication Interface (92)
MEMORY ARRANGEMENT (94)

FIGURE 6

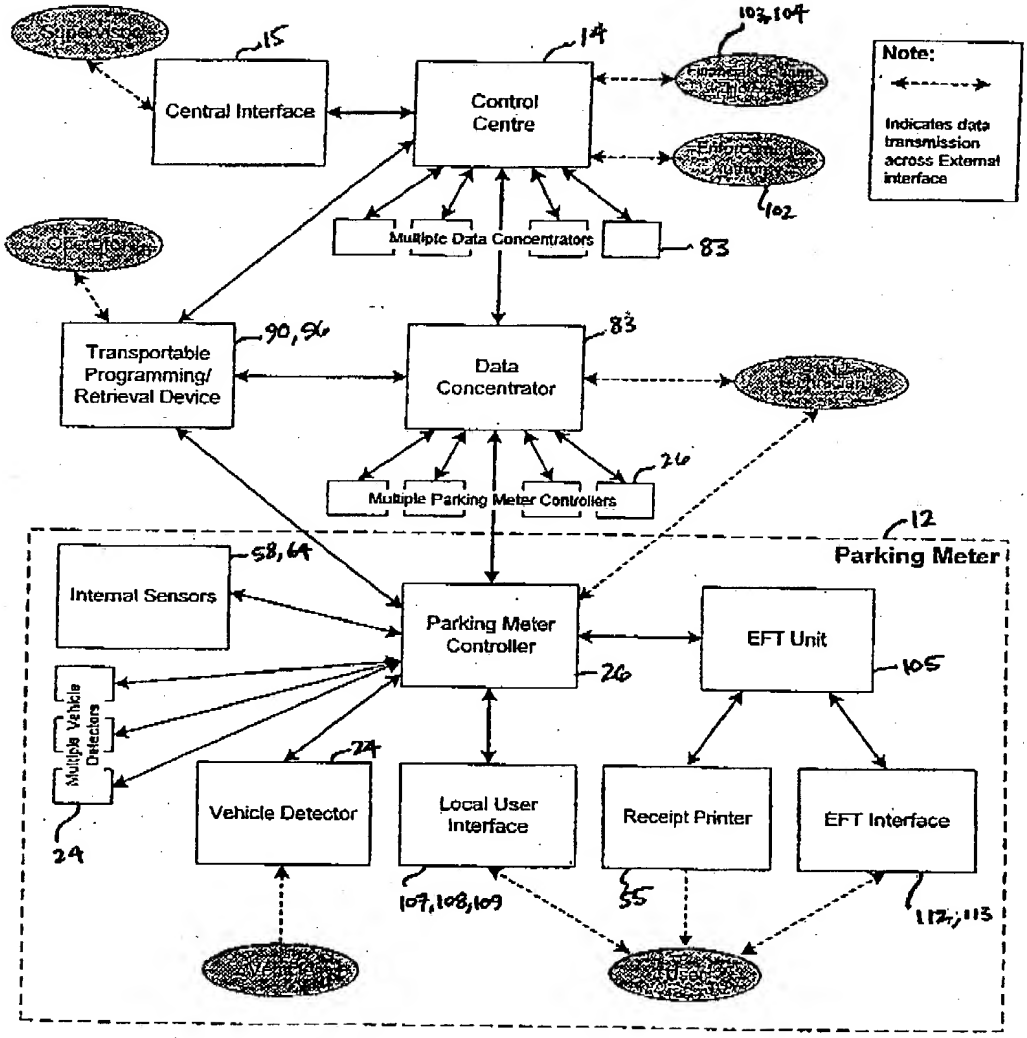

Supervisor
15
Central Interface
14
Control Centre
10%,104
Note:
Indicates data transmission across External interface
Multiple Data Concentrators
83
Operator
Transportable Programming/ Retrieval Device
90, 96
Data Concentrator
83
Multiple Parking Meter Controllers
26
12
Parking Meter
Internal Sensors
58, 64
Parking Meter Controller
26
EFT Unit
105
Multiple Vehicle Detectors
24
29
Vehicle Detector
Local User Interface
107, 108, 109
Receipt Printer
55
EFT Interface
112, 113

FIGURE 7

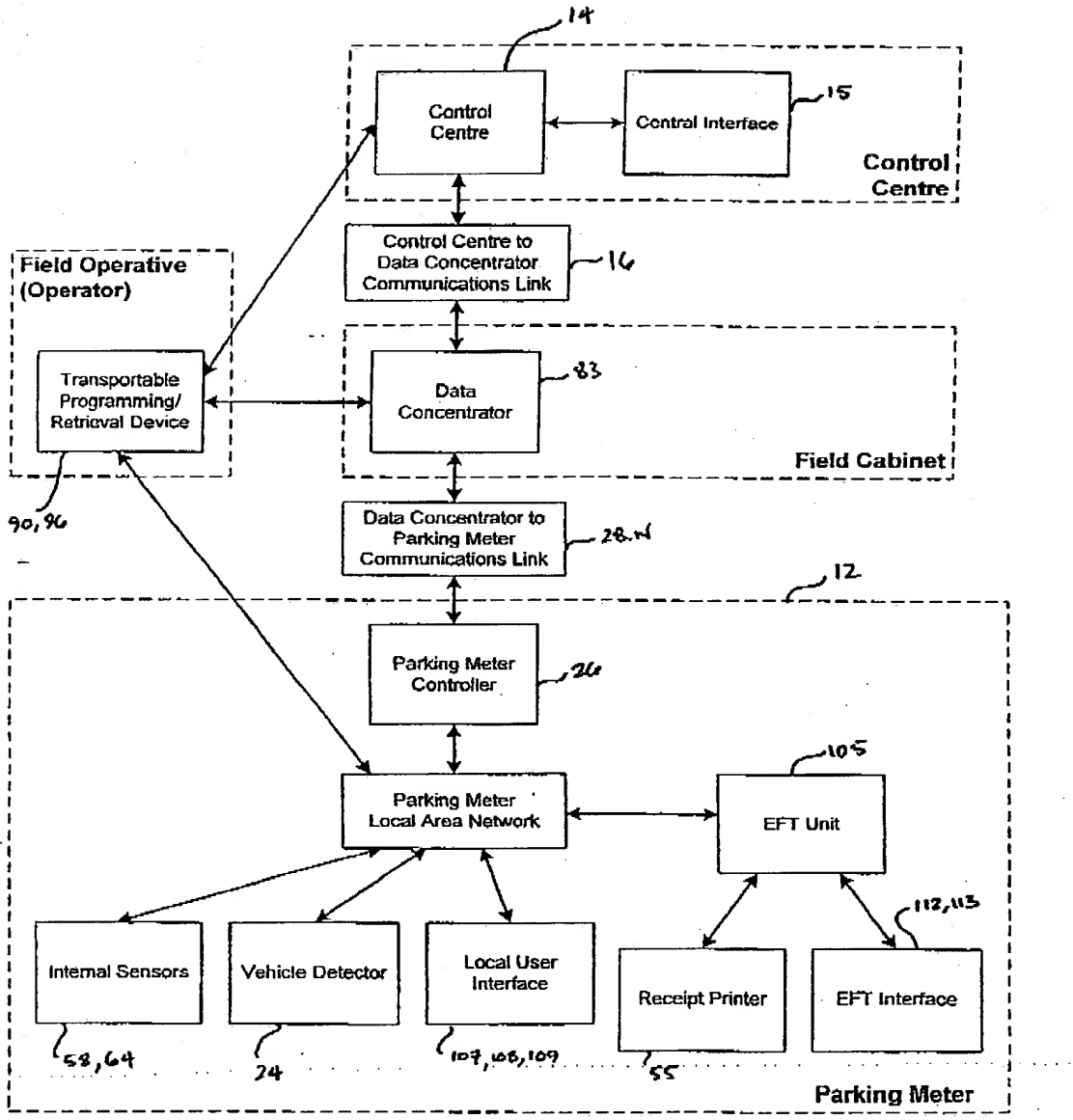

14
Control Centre
Central Interface
15
Control Centre
Control Centre to Data Concentrator Communications Link
16
Field Operative (Operator)
Transportable Programming/ Retrieval Device
Data Concentrator
83
Field Cabinet
90, 96
Data Concentrator to Parking Meter Communications Link
28-n
12
Parking Meter Controller
20
105
Parking Meter Local Area Network
EFT Unit
112, 113
Internal Sensors
Vehicle Detector
Local User Interface
Receipt Printer
EFT Interface
58, 64
24
107, 108, 109
55
Parking Meter

FIGURE 8

9/20

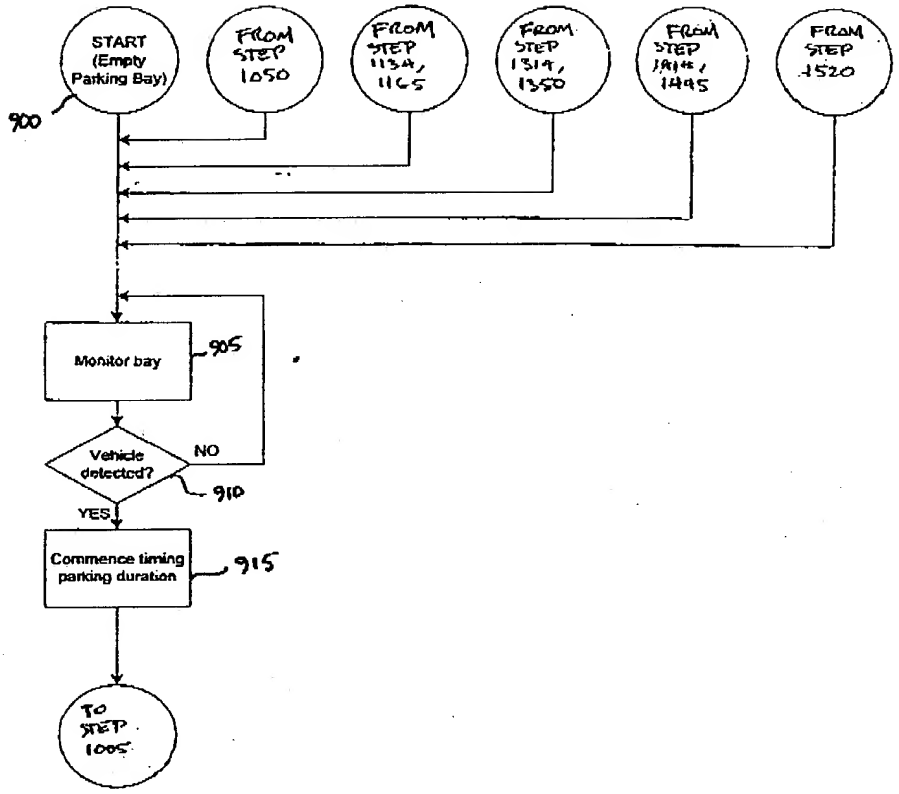
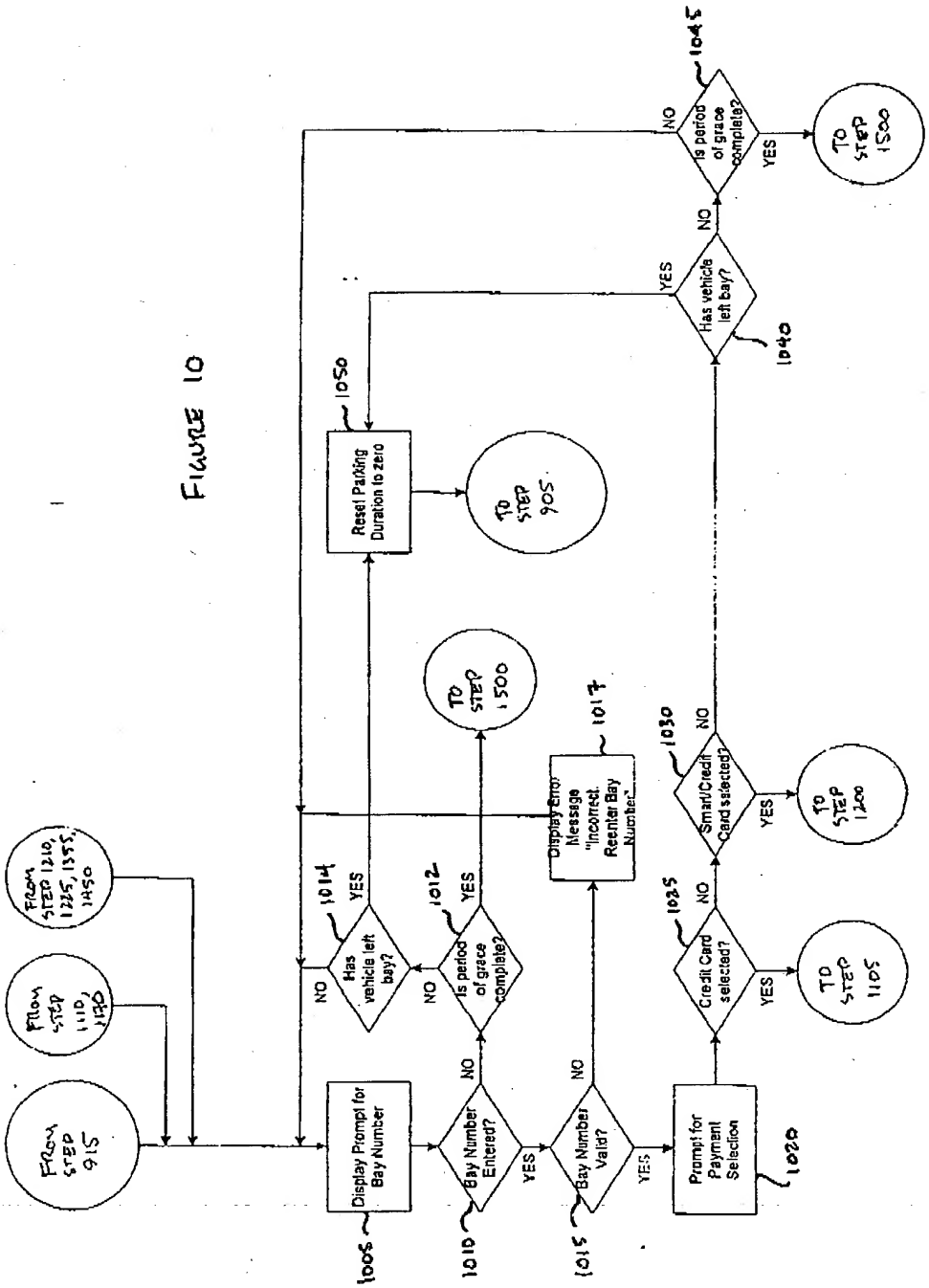

START (Empty Parking Bay)
900
FROM STEP 1050
FROM STEP 1134, 1165
FROM STEP 1319, 1350
FROM STEP 1814, 1495
FROM STEP 1520
Monitor bay
905
Vehicle detected?
NO
910
YES
Commence timing parking duration
915
TO STEP 1005

FIGURE 9

FIGURE 10


From Step 915
From Step 1110, 1210, 1250, 1350, 1450
From Step 1110, 1210
Display Prompt for Bay Number
1005
Bay Number Entered?
1010
Bay Number Valid?
1015
Prompt for Payment Selection
1020
Credit Card selected?
1025
To Step 1105
Smart/Credit Card selected?
1030
To Step 1200
Is period of grace complete?
1012
Has vehicle left bay?
1014
To Step 1500
Display Error Message "Incorrect. Reenter Bay Number"
1017
Reset Parking Duration to zero
1050
To Step 905
Has vehicle left bay?
1040
Is period of grace complete?
1045
To Step 1500
YES
NO

11/20

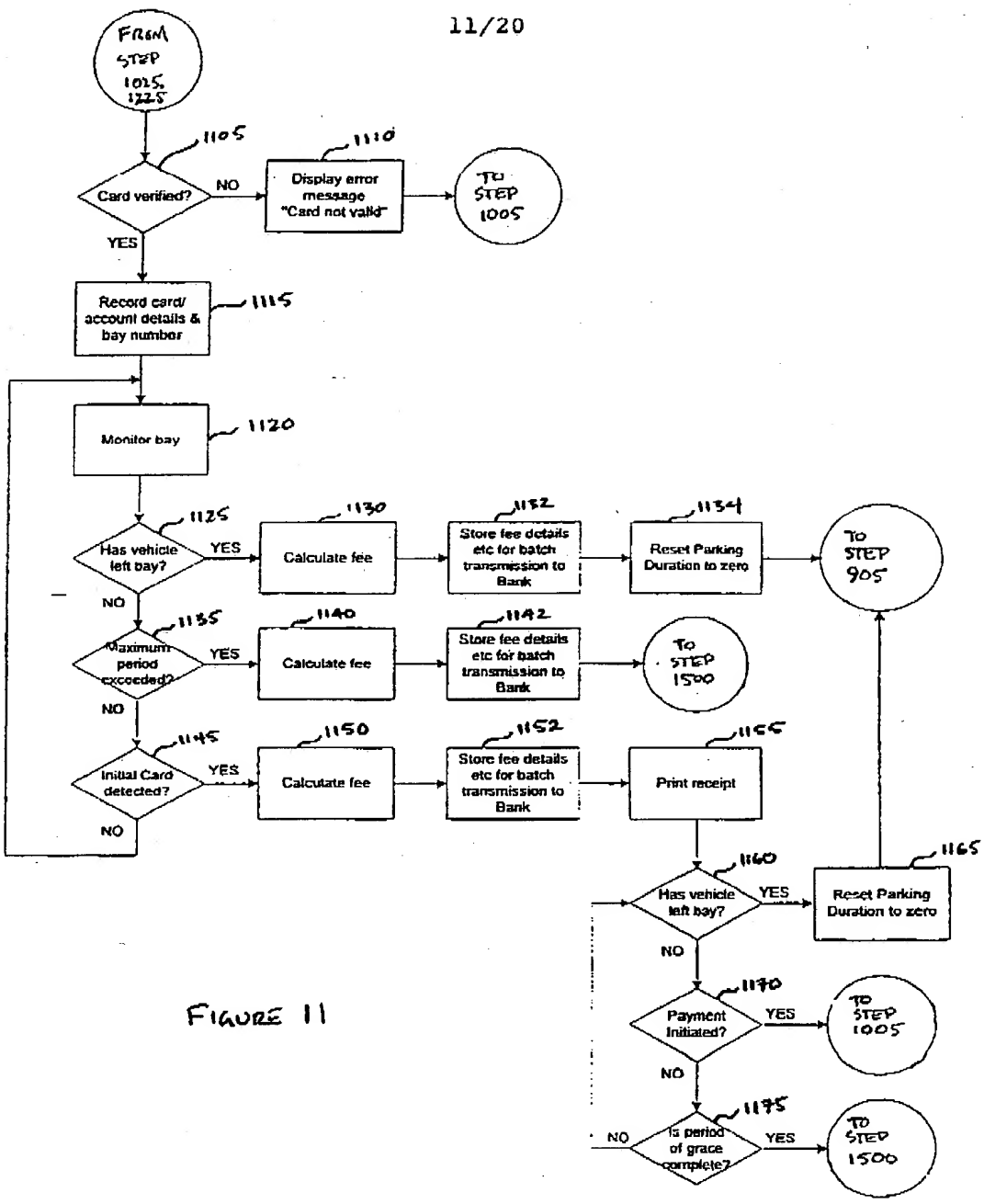



FIGURE 11

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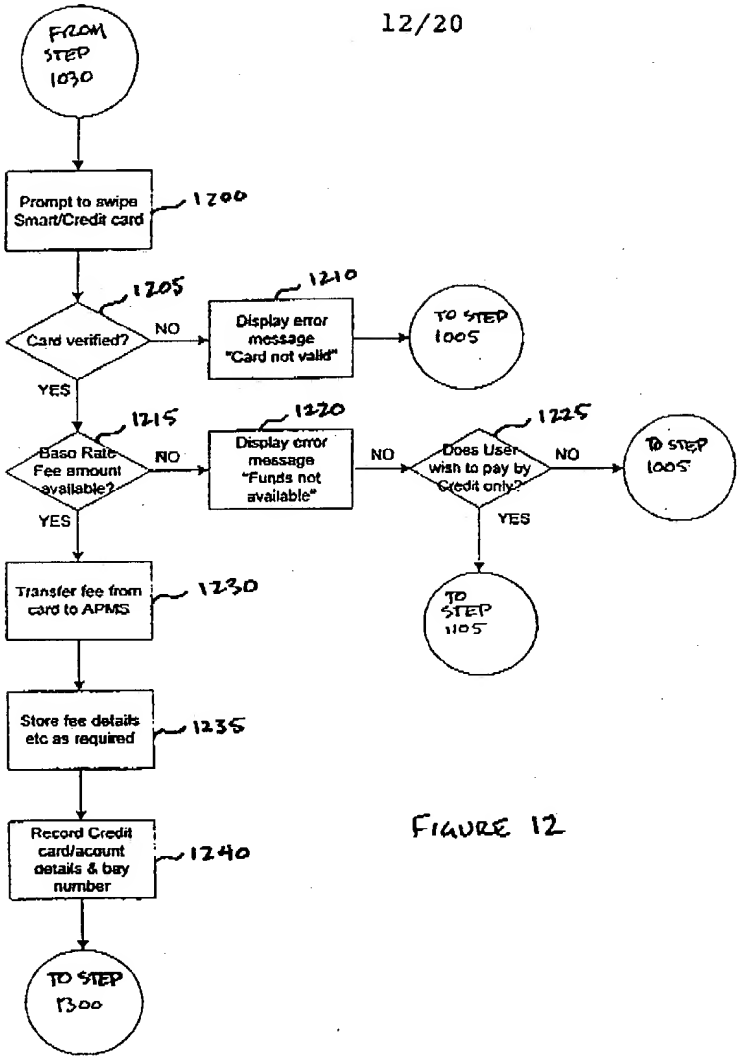


FIGURE 12

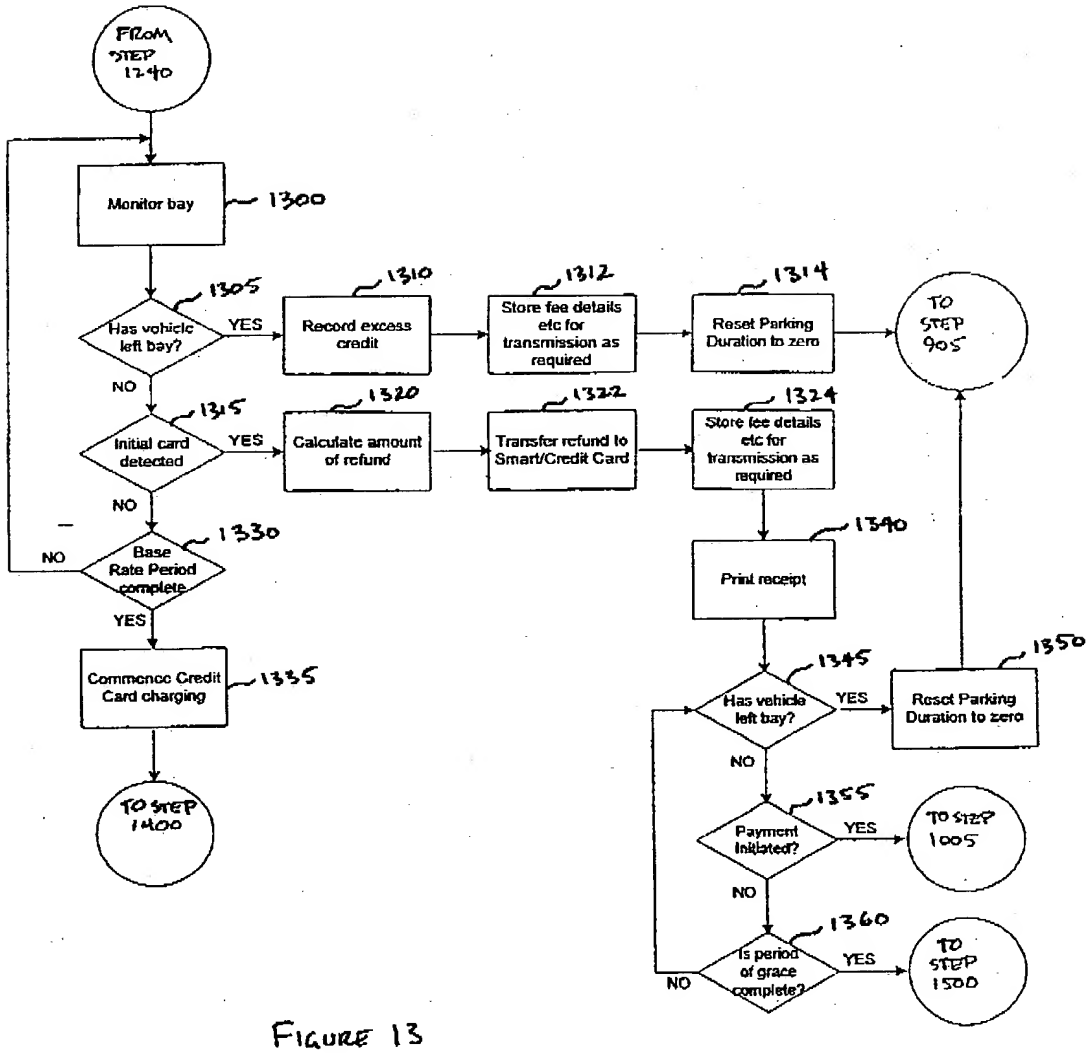
From STEP 1240
Monitor bay
1300
Has vehicle left bay?
1305
YES
Record excess credit
1310
Store fee details etc for transmission as required
1312
Reset Parking Duration to zero
1314
TO STEP 905
NO
Initial card detected
1315
YES
Calculate amount of refund
1320
Transfer refund to Smart/Credit Card
1322
Store fee details etc for transmission as required
1324
NO
Base Rate Period complete
1330
NO
YES
Print receipt
1340
Commence Credit Card charging
1335
Has vehicle left bay?
1345
YES
Reset Parking Duration to zero
1350
NO
Payment Initiated?
1355
YES
TO STEP 1005
NO
Is period of grace complete?
1360
YES
NO
TO STEP 1500
TO STEP 1400

FIGURE 13

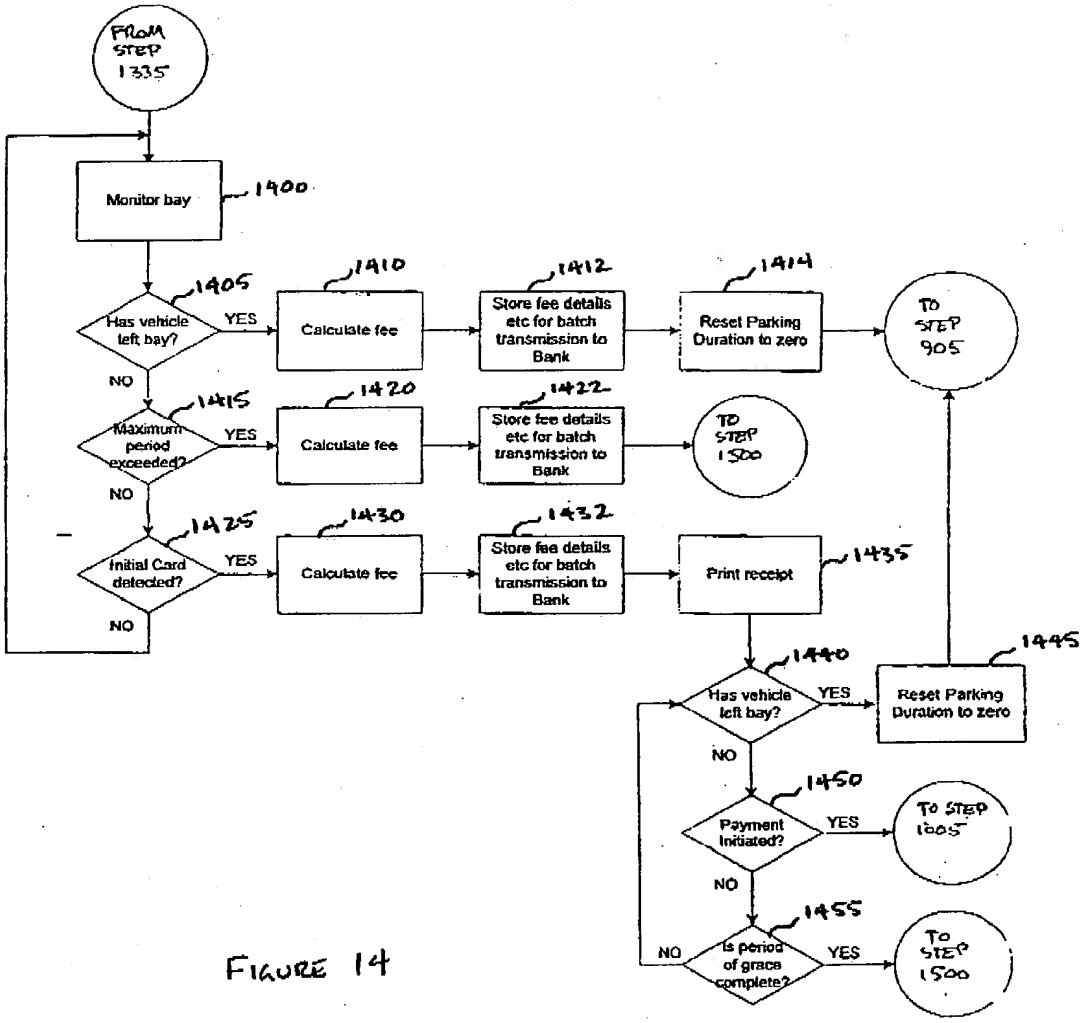
FROM STEP 1335
Monitor bay
1900
Has vehicle left bay?
1405
YES
NO
Calculate fee
1410
Store fee details etc for batch transmission to Bank
1412
Reset Parking Duration to zero
1414
TO STEP 905
Maximum period exceeded?
1415
YES
NO
Calculate fee
1420
Store fee details etc for batch transmission to Bank
1422
TO STEP 1500
Initial Card detected?
1425
YES
NO
Calculate fee
1430
Store fee details etc for batch transmission to Bank
1432
Print receipt
1435
Has vehicle left bay?
1440
YES
NO
Reset Parking Duration to zero
1445
Payment Initiated?
1450
YES
NO
To STEP 1605
Is period of grace complete?
1455
NO
YES
To STEP 1500

FIGURE 14

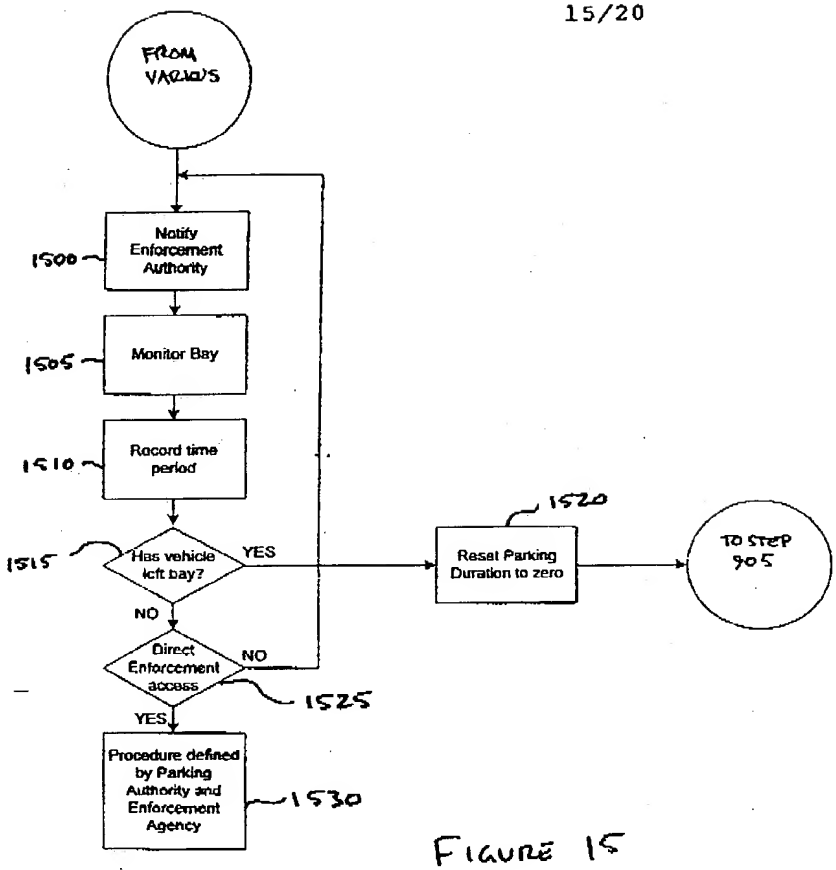
FROM VARIOUS
Notify Enforcement Authority
1500
Monitor Bay
1505
Record time period
1510
Has vehicle left bay?
1515
YES
NO
Direct Enforcement access
NO
YES
1525
Procedure defined by Parking Authority and Enforcement Agency
1530
Reset Parking Duration to zero
1520
TO STEP 905

FIGURE 15

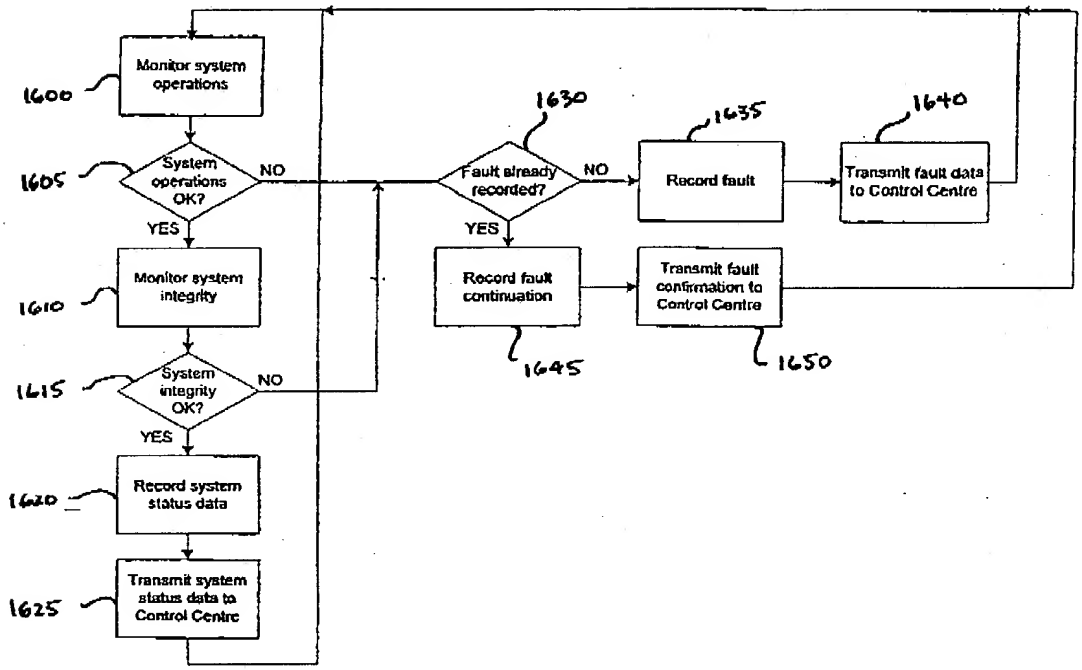
Monitor system operations
1600
System operations OK?
1605
NO
YES
Monitor system integrity
1610
System integrity OK?
1615
NO
YES
Record system status data
1620
Transmit system status data to Control Centre
1625
Fault already recorded?
1630
NO
YES
Record fault
1635
Transmit fault data to Control Centre
1640
Record fault continuation
1645
Transmit fault confirmation to Control Centre
1650

FIGURE 16

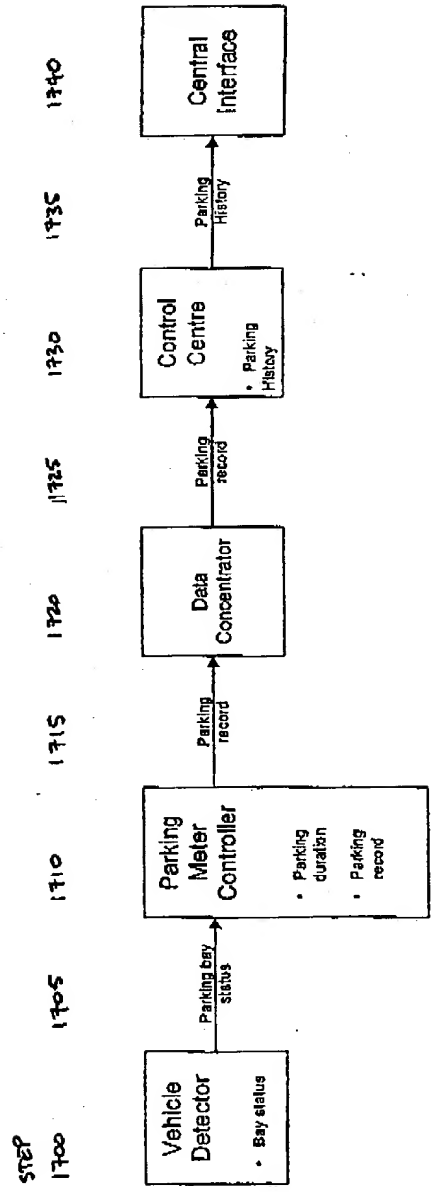
STEP
1700
1705
1710
1715
1720
1725
1730
1735
1740
Vehicle Detector
• Bay status
Parking bay status
Parking Meter Controller
• Parking duration
• Parking record
Parking record
Data Concentrator
Parking record
Control Centre
• Parking History
Parking History
Central Interface

FIGURE 17

09807608 .122601
09/807608





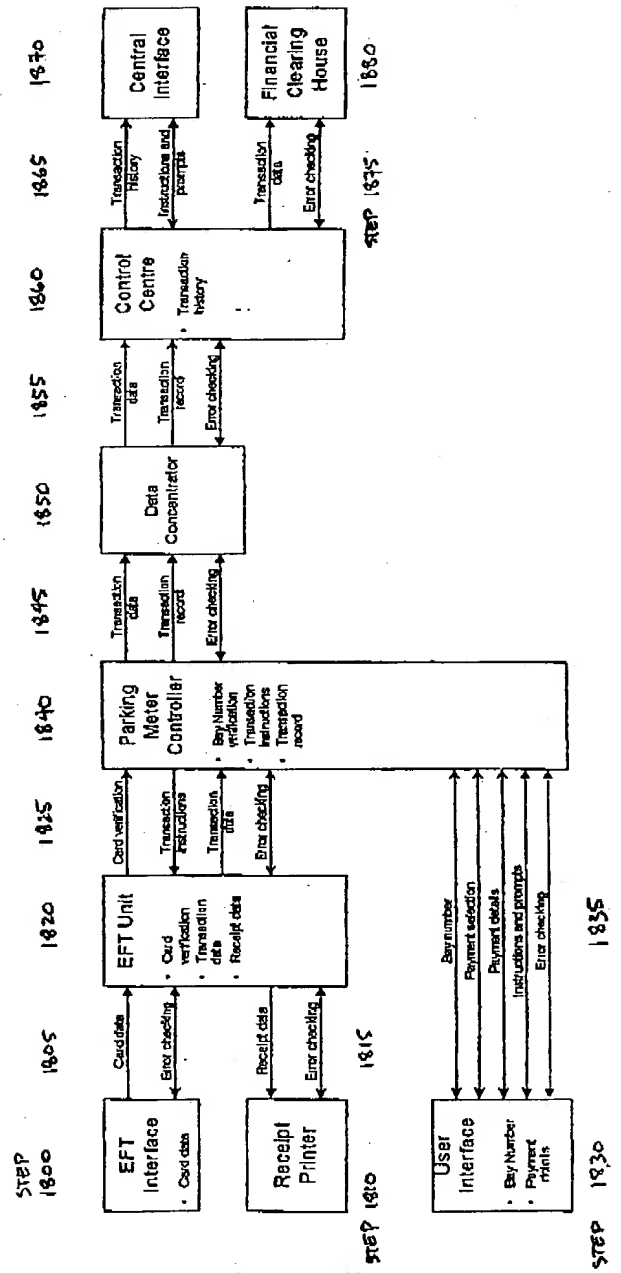


Figure 18

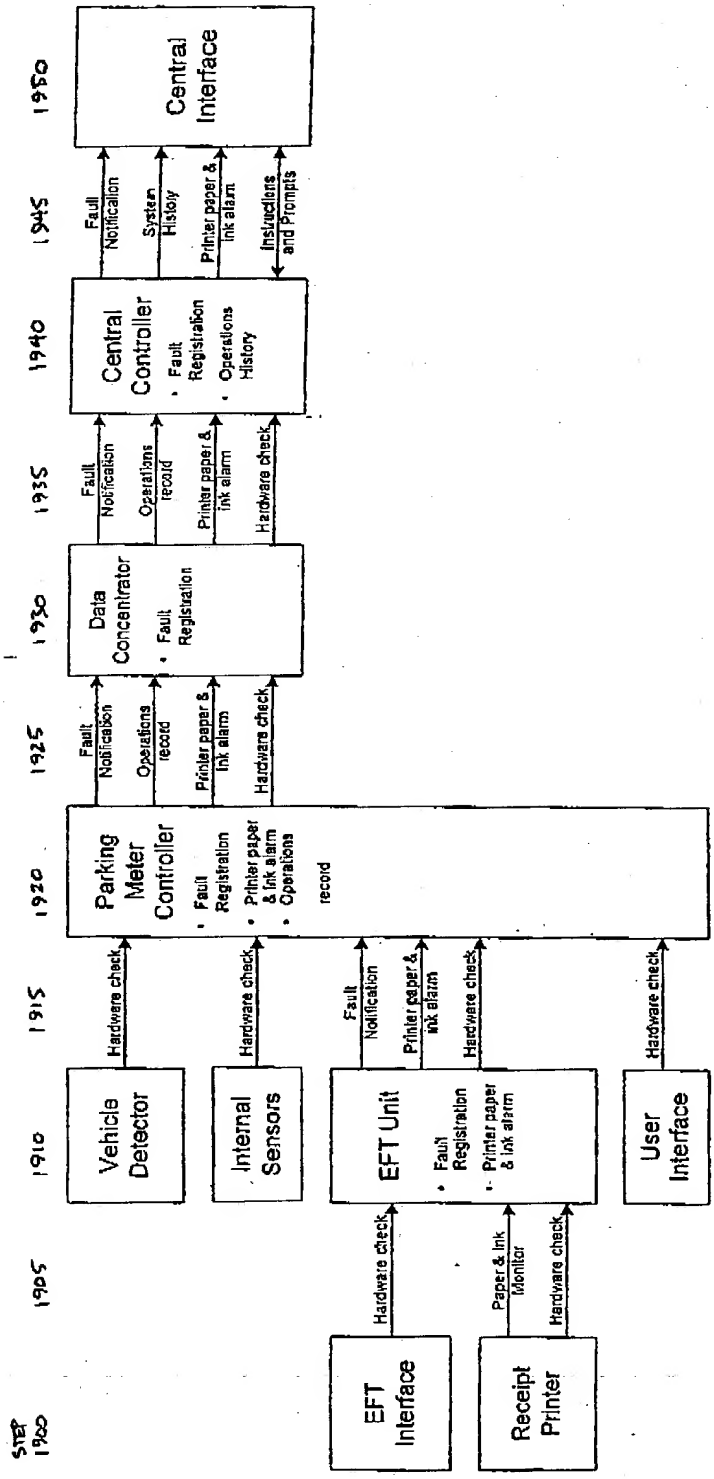
STEP
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
Vehicle Detector
Internal Sensors
EFT Unit
• Fault Registration
• Printer paper & ink alarm
User Interface
Parking Meter Controller
• Fault Registration
• Printer paper & ink alarm
• Operations record
Data Concentrator
• Fault Registration
Central Controller
• Fault Registration
• Operations History
Central Interface
EFT Interface
Receipt Printer
Hardware check
Paper & Ink fdonitor
Fault Notification
Printer paper & ink alarm
Operations record
System History
Instructions and Prompts

FIGURE 19

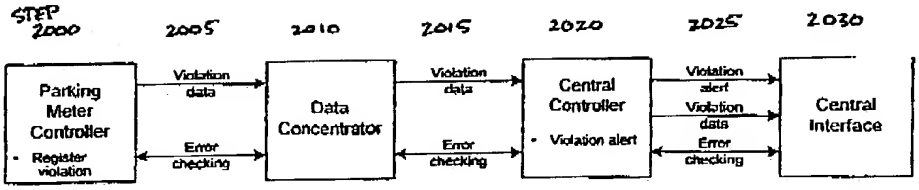
STEP 2000
2005
2010
2015
2020
2025
2030
Parking Meter Controller
- Register violation
Violation data
Error checking
Data Concentrator
Violation data
Error checking
Central Controller
- Violation alert
Violation alert
Violation data
Error checking
Central Interface

FIGURE 20

**SOLE/JOINT**

# DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; that I verily believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter claimed and for which a patent is sought in the application entitled: A PARKING MANAGEMENT SYSTEM

which application is:
☐ the attached application
*(for original application)*

☐ application Serial No. 09/807608
filed 16 April, 2001 , and amended on

*(for declaration not accompanying application)*

that I have reviewed and understand the contents of the specification of the above-identified application, including the claims, as amended by any amendment referred to above; that I acknowledge my duty to disclose information of which I am aware which is material to the patentability of this application under 37 C.F.R. 1.56, that I hereby claim priority benefits under Title 35, United States Code §119, §172 or §365 of any provisional application or foreign application(s) for patent or inventor's certificate listed below and have also identified on said list any foreign application for patent or inventor's certificate on this invention having a filing date before that of any foreign application on which priority is claimed:

| Application Number | Country | Filing Date | Priority Claimed *(yes or no)* |
|---|---|---|---|
| PP6557/98 | Australia | 16 October, 1998 | Yes |

I hereby claim the benefit of Title 35, United States Code §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in a listed prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge my duty to disclose any information material to the patentability of this application under 37 C.F.R. 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

| Application Serial No. | Filing Date | Status *(patented, pending, abandoned)* |
|---|---|---|

I hereby appoint John H. Mion, Reg. No. 18,879; Thomas J. Macpeak, Reg. No. 19,292; Robert J. Seas, Jr., Reg. No. 21,092; Darryl Mexic, Reg. No. 23,063; Robert V. Sloan, Reg. No. 22,775; Peter D. Olexy, Reg. No. 24,513; J. Frank Osha, Reg. No. 24,625; Waddell A. Biggart, Reg. No. 24,861; Louis Gubinsky, Reg. No. 24,835; Neil B. Siegel, Reg. No. 25,200; David J. Cushing, Reg. No. 28,703; John R. Inge, Reg. No. 26,916; Joseph J. Ruch, Jr., Reg. No. 26,577; Sheldon I. Landsman, Reg. No. 25,430; Richard C. Turner, Reg. No. 29,710; Howard L. Bernstein, Reg. No. 25,665; AJan J. Kasper, Reg. No. 25,426; Kenneth J. Burchfiel, Reg. No. 31,333; Gordon Kit, Reg. No. 30,764; Susan J. Mack, Reg. No. 30,951; Frank L. Bernstein, Reg. No. 31,484; Mark Boland, Reg. No. 32,197; William H. Mandir, Reg. No. 32,156; Brian W. Hannon, Reg. No. 32,778; Abraham J. Rosner, Reg. No. 33,276; Bruce E. Kramer, Reg. No. 33,725; Paul F. Neils, Reg. No. 33,102; Brett S. Sylvester, Reg. No. 32,765; Robert M. Masters, Reg. No. 35,603 and George F. Lehnigk, Reg. No. 36,359 my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and request that all correspondence about the application be addressed to SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC, 2100 Pennsylvania Avenue, N.W., Washington, D.C. 20037-3202.

30

**I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.**

Date 20/12/01 First Inventor Jack David HAMMOND
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Citizenship Australian Australia

Date 21/12/01 Second Inventor Michael Lindsay CRAIG
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Citizenship Australian

Date Fifth Inventor
(First Name) (Middle Initial) (Last Name)

Residence Signature

Post Office Address:

Citizenship

Date Sixth Inventor
(First Name) (Middle Initial) (Last Name)

Residence Signature

Post Office Address:

Citizenship

Date Seventh Inventor
(First Name) (Middle Initial) (Last Name)

Residence Signature

Post Office Address:

Citizenship

Rec'd PCT/PTO 26 DEC 2001

Applicant or Patentee: _____ Attorney's Dkt. No. Q63675

Serial or Paten: No.: _____

Filed or Issued _____

For: _____

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS [37 19(f) and 1.27(c)] - SMALL BUSINESS CONCERN**

I hereby declare that I am

☐ the owner of the small business concern identified below:

☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN APTOS CORPORATION PTY LTD

ADDRESS OF CONCERN 38 Poath Road, Hughesdale, Victoria 3166, Australia

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled:

A PARKING MANAGEMENT SYSTEM

by inventors Jack David HAMMOND AND Michael Lindsay CRAIG AND Arthur Thomas HALLETT AND Andrew Rainer GOCKEL described in

☐ the specification filed herewith.

☒ application Serial No. 09/807608, filed 16 April, 2001

☐ patent No. _____, issued _____

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor who could not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d), or a nonprofit organization under 37 CFR 1.9(e). *NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities (37 CFR 1.27)

Name _____

Address _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

Name _____

Address _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

I acknowledge the duty to file, in this application of patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. [37 CFR 1.28(b)]

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

* NAME OF PERSON SIGNING MICHAEL LINDSAY CRAIG

* TITLE OF PERSON OTHER THAN OWNER DIRECTOR / SECRETARY

* ADDRESS OF PERSON SIGNING 38 POATH ROAD, HUGHESDALE VICTORIA 3166 AUSTRALIA

SIGNATURE _____ DATE x 27 June 2001